REPORT NUMBER 56
Issued April 1996

CENTERS FOR DISEASE CONTROL AND PREVENTION

HEPATITIS SURVEILLANCE

HIGHLIGHTS

Risk of Acquiring Hepatitis C for Health-Care Workers and Recommendations for Prophylaxis and Follow-up After Occupational Exposure

Recent Increases in Reported Cases of Hepatitis C/non-A, non-B Hepatitis

Evaluating the Effectiveness of the Programs to Prevent Hepatitis B Virus Transmission in the United States

National Surveillance through 1993

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service

Preface

This report summarizes information from state health departments, university investigators, virology laboratories, and other pertinent sources, domestic and foreign, about acute viral hepatitis. Much of the information is preliminary. It is intended primarily for persons responsible for disease control. Contributions to the Hepatitis Surveillance Report are most welcome; send them to:

Chief, Viral Hepatitis Surveillance
Hepatitis Branch
Division of Viral and Rickettsial Diseases
National Center for Infectious Diseases
Centers for Disease Control and Prevention
Atlanta, GA 30333

Suggested Citation
Hepatitis Surveillance Report No. 56.
Atlanta: Centers for Disease Control and Prevention, 1995. 36 p.

Acknowledgments: Special contributions to this report were made by Frank Mahoney, M.D., Miriam Alter, Ph.D., and Elisabeth Loos. Special thanks to Mr. Carlisle Quantrell for programming and computer support.

HEPATITIS Surveillance

Contents

Introduction

Viral hepatitis in the United States has been a major public health problem for many years, with estimated medical treatment costs in the hundreds of millions of dollars annually. The long-term consequences of many of these viral infections are only now becoming apparent to many infected patients and their families. Infections caused by the hepatitis C virus (HCV), in particular, effectively resist the body's attempts to develop immunity, leading to persistent infection and chronic liver disease in a large percentage of those infected.

Thus, the declines in the incidence of hepatitis types A, B, and C reported in recent years are encouraging. This report summarizes surveillance data collected during 1993 for acute viral hepatitis. Reported cases of viral hepatitis in 1993 continued their overall downward trends with one exception. Hepatitis A increased by 5% from 1992 to 1993, and preliminary data for 1994-95 suggest that this increase will continue into 1996.

The objective of national surveillance of viral hepatitis is to provide serologic, demographic, and epidemiologic information that will aid in formulating strategies and policies for the prevention and control of these diseases. The hepatitis surveillance report interprets and disseminates this information, presents new developments in the field, and clarifies issues related to viral hepatitis. Nationwide information on hepatitis is obtained by two surveillance systems. In one, incidence data are collected from cases reported to the Centers for Disease Control and Prevention (CDC) National Notifiable Diseases Surveillance System (NNDSS) by each state and territory. The etiologic classification is made by physician diagnosis; confirmation by serologic testing is not required. The number of cases and date reported of each type of hepatitis appear in the *Morbidity and Mortality Weekly Report (MMWR)* and the *MMWR Annual Summary of Notifiable Diseases*, and are summarized in this report as well.

In the other system, clinical, serologic and epidemiologic data pertaining to risk factors of disease acquisition are obtained from the Viral Hepatitis Surveillance Program (VHSP), a separate reporting system operated by the Hepatitis Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, CDC, Atlanta, Georgia. The VHSP obtains its information from the viral hepatitis case record, a copy of which appears in the appendix. The case record was revised in 1989. By 1993, 95% of cases were reported with the revised form. This form (CDC 53.1) can be obtained from the Hepatitis Branch. In addition, in 1991 several states began submitting their case reports via electronic surveillance through the National Electronic Telecommunications System for Surveillance (NETSS). For states interested in using NETSS to report hepatitis cases, the Hepatitis Branch and CDC's Epidemiology Program Office will provide technical support.

A third surveillance system referenced in this report is the Sentinel Counties Study of Acute Viral Hepatitis, a more intensive study of viral hepatitis in six counties representative of the United States as a whole. This surveillance system has provided nationally representative data on acute viral hepatitis since 1982, and has been a resource for detecting emerging infections and performing more in-depth studies.

Surveillance data such as those reported here are dependent on the cooperation of state and local health departments, public health practitioners, and medical care persons, reporting the diseases from their hospitals, clinics, and offices. In recent years there has been a decline in both the frequency of states reporting, and the number of viral hepatitis cases reported to CDC through the VHSP. Since 1989, the number of states reporting to the VHSP most (75%-100%) of the cases they reported to NNDSS declined from 28 to 21, and an increasing number of states have stopped reporting altogether (see table on p. 22). In addition, the number of reports received by VHSP of those reported to the NNDSS has declined from 50% to 36%. The percentage of NNDSS cases reported to the VHSP has dropped particularly for hepatitis B and non-A,non-B (NANB) hepatitis. For symptomatic serologically confirmed hepatitis B, the VHSP received reports on only 26% of the hepatitis B cases reported to NNDSS, and for symptomatic, serologically confirmed NANB hepatitis, the VHSP received reports on only 18% of the cases reported to NNDSS.

CDC's ability to accurately analyze and interpret nationwide trends and patterns, identify high-risk groups, and determine mechanisms of transmission for each type of hepatitis depends on the cooperation of the state and local health departments in reporting laboratory and epidemiologic data to the VHSP. Key to these tasks is the accurate determination of the specific agent causing the viral hepatitis. Six distinct agents are responsible for viral hepatitis worldwide; four have been identified as endemic in the United States: hepatitis types A, B, C, and D. In 1993, hepatitis A accounted for 56% of reported cases; hepatitis B, 31%, hepatitis C/NANB, 11%; and hepatitis unspecified, 1%. Delta hepatitis is not a reportable disease in the United States, and occurs as a coinfection or superinfection with hepatitis B.

The etiology of viral hepatitis cannot be determined by clinical or epidemiologic characteristics alone. The wide availability of diagnostic tests to characterize hepatitis A, hepatitis B, and hepatitis C makes the reporting of etiologic classification based on clinical and epidemiologic characteristics obsolete and hinders the clinical and public health management of patients with these diseases. However, there are several limitations of the serologic assay for HCV infection; some cases caused by HCV may not develop antibody to HCV (anti-HCV). Also, because patients with acute hepatitis C may take 6 to 9 months to become anti-HCV positive, and because the anti-HCV assay does not distinguish between acute and chronic infection, diagnosis of hepatitis C and NANB hepatitis both require serologic exclusion of acute hepatitis A and hepatitis B. Reporting of NANB hepatitis should not be dependent on testing for anti-HCV.

Disease under reporting and inaccurate diagnosis impede the public health community's ability to develop guidelines for preventing and controlling hepatitis and to assess the impact of these prevention strategies. We thank those who have been actively contributing to our program and encourage others to participate.

Issues and Answers

What is the risk of acquiring hepatitis C for health care workers and what are the recommendations for prophylaxis and follow-up after occupational exposure to hepatitis C virus?

Hepatitis C virus (HCV) is most efficiently transmitted by large or repeated percutaneous exposures to blood, such as through the transfusion of blood or blood products from infectious donors and sharing of contaminated needles among injection drug users. Other blood-borne viruses, such as the hepatitis B virus (HBV), are transmitted not only by overt percutaneous exposures, but by mucous membrane and inapparent parenteral exposures. Although these types of exposures are prevalent among health-care workers, the risk factors for HCV transmission in this occupational setting are not well-defined.

Occupational Transmission

A case-control study of patients with acute non-A, non-B hepatitis, conducted prior to the discovery of HCV, found a significant association between acquiring disease and health-care employment, specifically patient care or laboratory work (1). Seroprevalence studies have reported antibody to HCV (anti-HCV) rates of 1% among hospital-based health-care workers in western countries (2). In the one study that assessed risk factors for infection, a history of accidental needle sticks was independently associated with anti-HCV positivity (3). Case reports have documented the transmission of HCV infection from anti-HCV positive patients to health-care workers as a result of accidental needle sticks or cuts with sharp instruments (2), and one reported the transmission of HCV from a blood splash to the conjunctiva (4). In follow-up studies of health-care workers who sustained percutaneous exposures to blood from anti-HCV positive patients, the incidence of anti-HCV seroconversion (based on second-generation testing) averaged 3.5% (range, 0%-7%) (5-9); in the one study that used polymerase chain reaction (PCR) to measure HCV infection by detecting HCV RNA, the incidence was 10% (5).

Nosocomial Transmission

Nosocomial transmission of HCV is also possible if breaks in technique occur or disinfection procedures are inadequate and contaminated equipment is shared between patients. Hospitalized patients may serve as a reservoir for transmission; the prevalence of anti-HCV among such patients has been reported to range from 2% to 18% (10-12). Case control studies have not found an association between standard medical care procedures and transmission of HCV in the United States (1,13). However, in one report from Greece, 6 patients with acute non-A, non-B hepatitis (5 of whom were anti-HCV positive) all had onset of their disease within a 9 day period, and all had been hospitalized 2 to 3 months previously at the same hospital; none had received transfusions or undergone surgery (14). In Australia, four patients who underwent outpatient surgery on the same day became infected with HCV of the same genotype as a chronically infected patient who underwent surgery just prior to the cases (15). The factors responsible for transmission could not be identified, and none of the surgical personnel were anti-HCV positive. In a report from Spain, however, five open heart surgery patients with documented acute HCV infection appeared to have acquired their infection from a cardiovascular surgeon with chronic hepatitis C (16). By sequence analysis, a high degree of homology was demonstrated between the virus of the surgeon and those of the patients. The factors responsible for transmission were not identified.

Postexposure Prophylaxis

Unfortunately, postexposure prophylaxis with immune globulin does not appear to be effective in preventing hepatitis C. Historically, several studies have attempted to assess the value of prophylaxis with immune globulin for the prevention of posttransfusion NANB hepatitis, but the results are difficult to compare and interpret because of lack of uniformity in diagnostic criteria, mixed sources of donors (volunteer and commercial), and different study designs (some lack blinding and placebo controls). In some of these studies, immune globulins seemed to reduce the rate of clinical disease although not overall infection rates; in one, patients receiving immune globulin were less likely to develop chronic hepatitis. None of these data have been reanalyzed since anti-HCV testing became available, and in only one study was the first dose of immune globulin given after, rather than before, the exposure, making it difficult to assess its value for postexposure prophylaxis.

At least 85% of persons with HCV infection become chronically infected, and chronic liver disease with persistently elevated liver enzymes develops in an average of 67% (2). These extraordinarily high rates of chronic disease and persistent viremia in humans, as well as animal transmission experiments demonstrating the failure of antibody elicited by infection with one genotype to cross-neutralize either heterologous genotypes or closely related but heterogeneous species within the same genotype, indicate the absence of an effective neutralizing immune response (17,18). Furthermore, immune globulin is now manufactured from plasma that has been screened for anti-HCV. A recently conducted experimental study in chimpanzees found that immune globulin manufactured from screened plasma administered 1 hour after exposure to HCV did not prevent infection or disease (19). In February 1994, the Immunization Practices Advisory Committee reviewed the available data and concluded that there was no support for the use of immune globulin for postexposure prophylaxis of hepatitis C (CDC, unpublished data). There is no information regarding the use of anti-viral agents, such as alpha interferon, in the postexposure setting, and such treatment is not recommended.

Issues Regarding Follow-Up After Exposure

In the absence of postexposure prophylaxis, multiple issues need to be considered in deciding if there should be a defined protocol for the follow-up of health-care workers for HCV infection after occupational exposures. These areas include the limited data on the risk of transmission, the limitations of available serologic testing for detecting infection and determining infectivity, the poorly defined risk of transmission by sexual, household, and perinatal exposures, the limited benefit of therapy for chronic disease, the cost of follow-up, and the medical-legal implications.

Although it seems clear that needle-stick exposure to infectious blood is a risk factor for hepatitis C, and that this risk appears to be intermediate between that of HBV and human immunodeficiency virus, the data are limited or nonexistent on the risk of transmission associated with other types of occupational exposure. This makes it difficult to provide health-care workers who sustain such exposures with a meaningful estimate of their chances of developing HCV infection. Testing methods readily available in the clinical setting also have limitations. With the commercially manufactured enzyme immunoassays (EIAs) that detect anti-HCV, there may be a prolonged interval between exposure and seroconversion, although the average time period is 8-10 weeks. In many populations, including health-care workers, the rate of false positivity for anti-HCV is high, and supplemental assays should always be used to judge the validity of repeatedly reactive EIA results. About 5% to 10% of infections will not be detected unless PCR is used to detect HCV RNA. Although such assays for HCV RNA are available from several commercial laboratories on a research-use basis, they are not standardized and the cost is high, about $200 per test. Both false-positive and false-negative results can occur from improper handling and storage or contamination of the test samples. In addition, the detection of HCV RNA may be intermittent, and the meaning of a single negative PCR test result is not conclusive.

All anti-HCV-positive persons should be considered potentially infectious, however, neither the presence of antibody nor the presence of HCV RNA is a direct measure of infectivity in settings where inapparent parenteral or mucosal exposures occur. Epidemiologic studies have implicated exposure to infected sexual and household contacts as well as to multiple sexual partners in the transmission of HCV (1,13). Serologic studies of the long-term sexual and household contacts of patients with chronic hepatitis C have found evidence of HCV infection in an average of 5% of sexual partners and in an average of 3% of children (2). Studies of infants born to anti-HCV-positive mothers have reported rates of perinatal transmission ranging from 0% to 13% (average 6%); in two small studies, only mothers with “high” titers of HCV RNA transmitted HCV to their infants (20,21). The inconsistent results of these as well as studies that looked for HCV RNA in body fluids other than serum and plasma may reflect different concentrations of virus in the infected persons sampled. The risk that an HCV-infected individual will transmit the virus may be related to the type and size of the inoculum and the route of transmission, as well as the titer of virus, but data on the threshold concentration of virus needed to transmit infection are insufficient. In the absence of such data and standardized tests to measure infectivity, it is difficult to counsel anti-HCV-positive persons about their risk of transmission to others (22). Because the risk of HCV transmission between long-term steady sexual partners appears to be low, there are no recommendations for changes in sexual practices for persons with a steady sexual partner, although infected persons should be informed of the possible risk so they can decide if they wish to take precautions. Household articles such as toothbrushes and razors should not be shared. There are no data to support discouraging either pregnancy or subsequent breast feeding (see reference 22 for further details on counseling)

The most obvious benefit from a follow-up protocol would appear to be the opportunity for the health-care worker to seek evaluation for chronic liver disease and treatment, if eligible. Studies have shown that alpha interferon therapy may have a beneficial effect among some patients (23). In these studies, however, the patients were highly selected and therapy resulted in sustained improvement in 20% or fewer of those treated; no clinical, demographic, serum biochemical, serologic or histologic features have been identified that reliably predict which patients will respond to treatment and sustain a long-term remission. The nationwide cost of providing postexposure follow-up testing is estimated at $2 to $4 million; the cost for each person who benefits from therapy is estimated at $200,000 (CDC, unpublished data).

Even in the absence of both available postexposure prophylaxis and limited specific measures for disease prevention, individual institutions should consider implementing policies and procedures for follow-up after percutaneous or per mucosal exposure to anti-HCV positive blood to address individual workers' concerns about their risk and outcome. Above all, institutions should ensure education of health-care providers regarding the risk and prevention of blood borne infections in the occupational setting (24), including hepatitis C, and such information should be routinely updated to ensure accuracy.

Summary Recommendations

1. No postexposure prophylaxis is available for hepatitis C; immune globulin is not recommended.
2. Institutions should provide to health-care workers accurate and up-to-date information on the risk and prevention of all blood borne pathogens, including hepatitis C.
3. Institutions should consider implementing policies and procedures for follow-up of health-care workers after percutaneous or per mucosal exposure to anti-HCV positive blood. Such policies might include baseline testing of the source for anti-HCV and baseline and 6 month follow-up testing of the person exposed for anti-HCV and ALT activity. All anti-HCV results reported as repeatedly reactive by EIA should be confirmed by supplemental anti-HCV testing.
4. There are currently no recommendations regarding restriction of health-care workers with hepatitis C. The risk of transmission from an infected worker to a patient appears to be very low. Furthermore, there are no serologic assays that can determine infectivity nor are there data to determine the threshold concentration of virus required for transmission. As recommended for all health-care workers, those who are anti-HCV positive should follow strict aseptic technique and standard (universal) precautions, including appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments.

Selected References

1. Alter MJ, Gerety RJ, Smallwood L, et al. Sporadic non-A, non-B hepatitis: frequency and epidemiology in an urban United States population. J Infect Dis 1982;145:886-893.
2. Alter MJ. Epidemiology of hepatitis C in the West. Semin Liver Dis 1995;15:5-14.
3. Polish LB, Tong MJ, Co RL, et al. Risk factors for hepatitis C virus infection among health care personnel in a community hospital. Am J Infect Control 1993;21:196-200.
4. Sartori M, La Terra G, Aglietta M, et al. Transmission of hepatitis C via blood splash into conjunctiva. Scand J Infect Dis 1993;25:270-271.
5. Mitsui T, Iwano K, Masuko K, et al. Hepatitis C virus infection in medical personnel after needlestick accident. Hepatology 1992;16:1109-1114.
6. Hernandez ME, Bruguera M, Puyuelo T, Barrera JM, Sanchez Tapias JM, Rodes J. Risk of needle-stick injuries in the transmission of hepatitis C virus in hospital personnel. J Hepatol 1992;16:56-58.
7. Zuckerman J, Clewley G, Griffiths P, Cockcroft A. Prevalence of hepatitis C antibodies in clinical health-care workers. Lancet 1994;343:1618-1620.
8. Petrosilla N, Puro V, Ippolito G, and Italian Study Group on Blood-borne Occupational Risk in Dialysis. Prevalence of hepatitis C antibodies in health-care workers. Lancet 1994;344:339-340.
9. Lanphear BP, Linnemann CC, Cannon CG, et al. Hepatitis C virus infection in health care workers: risk of exposure and infection. Infect Control Hosp Epidemiol 1994;15:745-750.
10. Louie M, Low DE, Feinman SV, et al. Prevalence of bloodborne infective agents among people admitted to a Canadian hospital. Can Med Assoc J 1992;146:1331-1334.
11. Kelen GD, Green GB, Purcell RH, et al. Hepatitis B and hepatitis C in emergency department patients. N Engl J Med 1992;326:1399-1404.
12. Bile K, Aden C, Norder H, et al. Important role of hepatitis C virus infection as a cause of chronic liver disease in Somalia. Scand J Infect Dis 1993;25:559-564.
13. Alter MJ, Coleman PJ, Alexander WJ, et al. Importance of heterosexual activity in the transmission of hepatitis B and non-A, non-B hepatitis. JAMA 1989;262:1201-1205.
14. Tassopoulos NC, Hatzakis A, Vassilopoulou-Kada H, et al. Hepatitis C virus is associated with hospital epidemic of acute non-a, non-B hepatitis [abstract]. Program and Abstracts of the 1990 International Symposium on Viral Hepatitis and Liver Disease, Houston, 1990, p.155.
15. NSW Health Department. Investigation of possible patient-to-patient transmission of hepatitis C in a hospital. NSW Public Health Bulletin 1994;5:47-51.
16. Esteban JI, Gomez J, Martell M, et al. Repeated transmission of HCV from surgeon to patients during cardiac surgery [abstract]. Hepatology 1995;22:347A.

17. Bukh J, Miller RH, Purcell RH. Genetic heterogeneity of hepatitis C virus: quasispecies and genotypes. Sem Liv Dis 1995;15:41-63.
18. Farci P, Alter HJ, Wong DC, et al. Prevention of hepatitis C virus infection in chimpanzees after antibody-mediated in vitro neutralization. Proc Natl Acad Sci 1994;91:7792-7796.
19. Krawczynski K, Alter MJ, Tankersley DL, et al. Effect of immune globulin on the prevention of experimental hepatitis C virus infection. J Infect Dis 1996, in press.
20. Ohto H, Terazawa S, Sasaki N, et al. Transmission of hepatitis C virus from mothers to infants. N Engl J Med 1994;330:744-750.
21. Lin HH, Kao JH, Hsu HY, et al. Possible role of high-titer maternal viremia in perinatal transmission of hepatitis C virus. J Infect Dis 1994;169:638-641.
22. Centers for Disease Control. Public Health Service inter-agency guidelines for screening donors of blood, plasma, organs, tissues, and semen for evidence of hepatitis B and hepatitis C. MMWR 1991:40(RR-4):13-14.
23. Fried MW, Hoofnagle, JH. Therapy of hepatitis C. Semin Liver Dis 1995;15:82-91.
24. Centers for Disease Control. Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. MMWR 1988;37:377-382,387-388.

Is the recent increase in the reported cases of hepatitis C / NANB a real increase?

Introduction

The numbers of hepatitis C and non-A, non-B (NANB) hepatitis cases reported in the United States have fluctuated dramatically in the last 5 years, particularly since tests for antibody to hepatitis C virus (anti-HCV) were introduced in 1990. In addition, the reported incidence of this disease has varied considerably between different surveillance systems (Table 1). The incidence of hepatitis C reported to the National Electronic Telecommunications System for Surveillance (NETSS) declined moderately from 1985 to 1990, but then increased by almost 130% from 1990 to 1992. The incidence rate in 1994 was still 73% higher than its 1990 level. In contrast, the incidence of hepatitis C in the Sentinel Counties Study of Acute Viral Hepatitis (1), which was initially 4-fold higher than the NETSS reported incidence, declined by 80% from 1989 through 1989. A similar decline was also observed in cases reported to the Viral Hepatitis Surveillance Program (VHSP). Possible reasons for these discrepancies include the widespread use of new diagnostic tests in laboratory-based reporting. The increase in cases reported to NETSS may have been the result of laboratory reports of chronically infected patients, or anti-HCV positive patients identified through screening programs. To better determine the reasons for these changes in nationwide reporting, during July-August of 1995 the Hepatitis Branch conducted a survey of a sample of county health departments to determine their practices and policies with regard to the reporting of hepatitis C and NANB hepatitis cases.

Methods

Counties were selected as a stratified random sample of those counties that had reported at least one case of hepatitis C / NANB in 1993. The selection list consisted of 790 such counties, and a 20% sample of 161 counties was selected. Stratification of the sample by population size ensured that large counties would have a high probability of selection.

Each county health department was asked to complete a questionnaire that covered seven categories: reporting sources of data, case definitions, laboratory reporting, follow-up for incomplete case reports, resources for surveillance, uses to which data were put, and information on respondents.

Results

The data presented here are based on a preliminary analysis of the first 90 questionnaires that were returned. This represented an early response rate of 56%. In a preliminary analysis comparing county health de-

Table 1. Reported Cases of Hepatitis C/non-A, non-B Hepatitis per 100,000 Population in Two Surveillance Systems, 1985-94

Year	NETSS*	Sentinel Counties†
1985	1.81	8.29
1986	1.55	8.65
1987	1.23	6.83
1988	1.07	7.64
1989	1.02	9.06
1990	1.03	5.51
1991	1.42	3.41
1992	2.36	2.35
1993	1.86	1.83
1994	1.78	1.70

* National Electronic Telecommunications Systems for Surveillance
† Sentinel Counties Study of Acute Viral Hepatitis

partments that had or had not responded, no differences were found in population size or geographic location. Respondents included public health nurses and epidemiologists. About half of the respondents had worked at the health department for more than 10 years.

Respondents cited hospitals (34%) as the most common source of case reports prior to 1991; laboratories were next (20%). From 1991 to the present, they cited laboratories as the most common source of case reports (53%); hospitals were second (30%). Physicians were cited as the third most common reporting source in each period. Blood banks and other sources were cited with similar rankings in each period.

Nearly half of the health departments surveyed did not apply published case definition criteria when reporting acute hepatitis C / NANB cases. Fifty-six percent of respondents said that a case would be reported as hepatitis C / NANB on the basis of a physician's diagnosis alone. Forty-nine percent said that they accepted cases on the basis of laboratory reports alone. Discrete dates of onset of symptoms were required by only 36% of respondents, and exclusion of hepatitis A and B was required by 40% of respondents.

A large percentage of respondents said they followed up on incomplete case reports; however, 39% of these respondents also stated that they would accept and report a case on the basis of a laboratory report alone. When asked how they obtained the information required to provide an accurate diagnosis, 96% of respondents said they contacted the physician who made the report. Sixty-eight percent did follow-up that included contacting the patient. Only 39% determined if supplemental testing was done on specimens that were reported positive for anti-HCV.

Among the 23% of respondents who did not do follow-up on incomplete case reports, 52% said other public health problems took priority, while 50% cited lack of personnel. Thirty-six percent cited the lack of any effective intervention for hepatitis C / NANB patients as a reason.

Eighty-five percent of respondents reported increases in the number of cases reported during the past 5 years, mostly owing to laboratory reporting of anti-HCV positivity without evidence of acute disease. Only 12% cited a true increase in the disease incidence in their county or jurisdiction.

When asked to cite actions taken by the county health department in response to reported cases of hepatitis C / NANB, 77% of respondents said they provided counseling to patients. Thirty percent said they published newsletters containing data on hepatitis C / NANB.

We asked respondents to suggest ways that CDC could improve reporting of hepatitis C / NANB. Most pronounced was an expression of confusion regarding what should be done with case reports of persons with chronic hepatitis C / NANB. Many respondents felt that CDC should publish a clearer, updated case definition. Many also wanted guidelines from CDC for follow-up of incomplete case reports. Respondents suggested that CDC create educational programs targeting health-care workers in an effort to increase the reporting of diseases to the county health departments.

Summary. Since testing for anti-HCV became widely available, county health departments have increasingly relied on laboratories as sources of case reports for hepatitis C / NANB. This has resulted in an artifactual increase in the reported incidence of hepatitis C because of the reporting of anti-HCV- positive persons with no clinical or epidemiologic evidence of acute disease. Physician-reported cases continue to be a small proportion of all reported hepatitis C / NANB cases. In addition, many county health departments confirmed that they pass these laboratory test positive results on to the state health departments without sufficient confirmation of acute disease. Primarily because of lack of personnel and other diseases being seen as higher priority, county health departments do not attempt to obtain additional information necessary to confirm acute disease.

Further analysis of the survey results is being conducted. Issues to be examined include the purpose of surveillance of viral hepatitis; the importance of focusing on acute, symptomatic disease to determine true incidence; and the need for separate surveillance systems to monitor patients with chronic infections and chronic liver disease. Such surveillance efforts in the future will depend on strict adherence to case definitions, and on adequate resources to support them. The case definition is shown on page 22 of this report.

References

1. Alter MJ, Mast, EE. The epidemiology of viral hepatitis in the United States. Gastroenterology Clinics of North America 1994;23:437-455.

New Horizons

Evaluating the effectiveness of the programs to prevent hepatitis B virus (HBV) transmission in the United States.

The Hepatitis Branch, in collaboration with the National Immunization Program, has drafted disease reduction goals for the prevention of hepatitis B virus (HBV) transmission in the United States (Table 1). These goals were developed with comments from state-based immunization staff and the Council of State and Territorial Epidemiologists. Unlike other vaccine-preventable disease reduction targets, the targets for hepatitis B are not based on acute disease surveillance reported through the National Notifiable Diseases Surveillance System (NNDSS). Because most HBV infections in children <10 years of age are asymptomatic, evaluation based on NNDSS data will not reliably measure the effectiveness of hepatitis B vaccination programs, especially those directed at infants. Assessment of programs that target infants should primarily be evaluated by vaccination coverage surveys. The utility of various data sources, including coverage surveys, population-based serologic surveys, and surveillance for acute disease for evaluating all of the components of hepatitis B prevention programs, will vary depending on the age-group targeted by the program (Table 2). As the data obtained by evaluation tools improves, additional disease reduction targets can be proposed,

Table 1. Disease Reduction Goals for Hepatitis B Vaccination Programs

Perinatal Program

1. Goals for the reduction of perinatal HBV infections in the United States.
   - By 2000, reduce the estimated number of perinatal infections by 80%, from 9,500 to 1,900.

   Objectives for HBsAg screening of pregnant women

   By 1998 ensure that:
   - every state has a law requiring HBsAg screening of all pregnant women.
   - every state has developed a method to evaluate HBsAg screening of pregnant women.

   By 2000 ensure that:
   - 90% of pregnant women are screened for HBsAg prior to delivery.

   Objectives for the identification and tracking of infants born to HBsAg positive women.

   By 2000, ensure that
   - 90% of the estimated 20,000 births to HBsAg-positive pregnant women are identified each year in the U.S.
   - 90% of infants born to HBsAg-positive women receive the first dose of hepatitis B vaccine and hepatitis B immune globulin (HBIG) at birth.
   - 90% of infants born to HBsAg-positive mothers receive the remaining 2 doses of hepatitis B vaccine by 6-8 months of age.
2. Goals for the prevention of HBV transmission in households of HBsAg-positive pregnant women.
   - by 1998, every state should establish a program to vaccinate household contacts of HBsAg-positive pregnant women.
   - by 2000, >70% of household contacts are offered hepatitis B vaccine each year.

Infant Vaccination Program

1. Goals for hepatitis B vaccination of infants
   - By the year 1998, ensure that 90% or more of 2 year-old children have received hepatitis B vaccine.

     Interim objectives for hepatitis B vaccination coverage of 2 year-old children
   - By 1998, ensure that all states have developed activities to ensure that children in ethnically defined populations where HBV infection is of high or intermediate endemicity (i.e., Alaskan Natives, Asian / Pacific Islanders, infants born to first generation immigrant / refugee women from countries with a high / intermediate endemicity of HBV infection) are completely vaccinated in the first 12 months of life.

Table 2. Relative Importance of Sources of Data for Determining the Effectiveness of Hepatitis B Vaccination.

Program/Age-group	Data Source: Coverage Surveys	Serologic Surveys	Disease Surveillance *
Prevention of Perinatal Infection	+++	+/-	+
Routine Infant Vaccination	+++	+++	+/-
Risk Group Vaccination under VFC			
Children of immigrant mothers	+	+++	+
Adolescents (i.e., STD clinics, drug treatment)	+++	+	+++
Vaccination of Adolescents at 11-12 years of age	+	+	+++

*This level of utility would be achieved only with addition of a special category for perinatal infection and if infants are tested and infections reported.

especially one for adolescent vaccination programs. The following narrative provides perspective on the relative importance of different data sources in evaluating each hepatitis B vaccination activity.

Program to prevent perinatal HBV infection

In 1990, federal funding became available to support programs to prevent perinatal HBV transmission in the United States. Considerable efforts have been made on program implementation; however, measuring the effectiveness of perinatal program activities has been challenging.

Coverage surveys: To assess the effectiveness of current activities, disease reduction goals have been established to evaluate key programmatic elements including; hepatitis B surface antigen (HBsAg) screening of pregnant women, immunoprophylaxis (hepatitis B immune globulin (HBIG) and vaccine) at birth, and completion of the vaccine series by 6-8 months of age (Table 1). These goals have been established to ensure that> 80% of perinatal HBV infections are prevented.

In March 1995, the Hepatitis Branch, CDC, conducted a survey of hepatitis B program coordinators to measure progress in reaching these goals. The results of this survey revealed that 12 states had laws or regulations requiring HBsAg screening of pregnant women. Overall, 52 program coordinators provided data on the prevalence of HBsAg screening. For women who received services in the public sector, most projects (60%) reported that >90% of pregnant women were screened; however, 20% of the program managers did not know what percentage of pregnant women were screened (Table 3). For women who received services in the private sector, 28% of projects reported that >90% of pregnant women were screened and >50% of the projects did not know what percentage of pregnant women were screened.

The birth of infants to HBsAg-positive women is the critical surveillance event in the perinatal program and reporting of these births is the major indicator of program effectiveness. To evaluate reporting, the Hepatitis Branch has provided projects with estimates on the number of births to HBsAg-positive women that occur each year in the United States (Table 3). These figures are based on natality data and the estimated prevalence of chronic HBV infection among pregnant women by race and ethnicity. Specifically, the estimates are derived by using the following race/ethnicity- specific rates of HBsAg positivity: whites = 0.13%; blacks = 0.5%; Hispanics = 0.12%; Asian, U.S.-born = 1.6%; Asian, foreign-born = 8.9%; other = 0.5%. Based on natality data, an estimated 20,000 infants are born to HBsAg-positive women each year in the United States.

The prevalence figures used to calculate the number of births to HBsAg-positive women are derived from the National Health and Nutrition Examination Survey (NHANES III). NHANES III is a population-based seroprevalence survey which includes approximately 21,000 people nationwide. NHANES III has a limited capacity to provide estimates on the number of HBsAg-positive births in each state. There are several reasons for this. NHANES has a limited sample size and the prevalence of HBsAg among women of childbearing age is low, thus, the confidence limits around the NHANES estimates are wide. In addition, NHANES cannot provide estimates on the prevalence of HBsAg for foreign-born Asian women (there are too few in the survey). These estimates are derived from the medical literature (1-5). Finally, it is likely there is considerable variability in the prevalence of HBsAg-positive women by race and ethnicity in different parts of the country.

Considering these limitations, CDC has calculated a “lower confidence limit” on the number of HBsAg-positive births that are expected to occur in each state. These calculations are derived using the standard error of the NHANES data and state-specific natality data. To evaluate reporting, projects can compare the total number of HBsAg-positive births identified each year to the number that are expected to occur based on natality data.

Table 3 shows that 7,500 HBsAg-positive births were identified in 1993 and that most projects reported approximately 20%-40% of the expected number of HBsAg-positive births. The rates of immunoprophylaxis for these infants are consistent with the national goals and provide a measure of the number of peri-

Table 3. Survey of hepatitis B program managers, March 1995, Vaccination and completion rates of inf ants born to HBsAg+ women in 1993

Site	%Women screened Public sector	%Women screened Private sector	Expected HBsAg+ birth	Lower 95% CL on pos. birth	HBsAg+ births identified	Observed/ Expected	# infants tracked	% of tracked with first dose at birth	% of tracked complete at 6-8 months
Alabama	>95	U	205	98	107	0.52	107	0.93	0.93
Alaska	U	90-95	132	93	NA	NA	NA	NA	NA
American Samoa	90-95	U	132	114	79	0.60	79	1.00	0.51
Arizona	<85	>95	192	105	30	0.16	0	NA	NA
Arkansas	>95	U	97	44	41	0.42	31	1.00	1.00
California	>95	>95	5508	4365	1872	0.34	1884	1.00	0.89
CNMI	85-89	90-95	147	130	80	0.54	80	NA	NA
Colorado	<80	<80	171	103	57	0.33	57	0.97	0.64
Connecticut	90-95	90-95	171	102	92	0.54	85	0.74	0.51
Delaware	95	U	43	24	11	0.26	11	0.82	0.36
Florida	100	U	636	344	272	0.42	272	0.98	0.77
Georgia	U	U	447	246	95	0.21	95	0.75	0.52
Hawaii	>95	>95	502	393	251	0.50	251	0.99	0.92
Idaho	NA	NA	33	15	NA	NA	NA	NA	NA
Illinois	90-95	90-95	852	537	25	0.03	14	1.00	0.86
Indiana	<80	U	196	87	26	0.13	11	1.00	0.82
Iowa	<80	U	102	56	18	0.18	18	1.00	0.56
Kansas	U	U	119	69	29	0.24	20	0.75	0.75
Kentucky	90-95	90-95	116	49	12	0.10	12	0.92	0.75
Louisiana	>95	U	290	152	398	1.38	338	0.91	0.49
Maine	U	80-89	33	15	12	0.36	12	1.00	1.00
Maryland	>95	U	416	267	146	0.35	146	0.99	0.68
Massachusetts	>95	U	415	285	208	0.50	208	0.89	0.57
Michigan	85-89	U	461	235	268	0.58	268	1.00	0.76
Minnesota	U	NA	292	197	213	0.73	213	1.00	0.78
Mississippi	>95	U	165	80	105	0.64	103	1.00	0.87
Missouri	100	U	226	113	17	0.08	17	0.88	0.76
Montana	NA	NA	26	11	NA	NA	NA	NA	NA
Nebraska	U	U	61	31	4	0.07	4	0.75	1.00
Nevada	<80	U	99	66	52	0.53	52	0.96	1.23
New Hampshire	>95	>95	32	14	7	0.22	7	1.00	NA
New Jersey	>95	U	619	419	1	0.00	1	1.00	1.00
New Mexico	90-95	U	72	37	35	0.49	35	NA	NA
New York	>95	>95	516	300	357	0.69	357	0.99	0.82
New York City	>95	>95	1205	912	1149	0.95	1149	0.98	0.78
North Carolina	90-95	U	352	180	67	0.19	0	NA	NA
North Dakota	<80	<80	21	10	3	0.14	3	1.00	0.33
Ohio	>95	U	443	213	135	0.30	109	1.00	0.87
Oklahoma	<80	U	154	83	14	0.09	14	1.00	0.43
Oregon	>95	U	160	104	84	0.53	84	0.99	0.46
Palau	>95	U	35	NA	50	1.43	50	0.94	0.9
Pennsylvania	<80	U	559	316	151	0.27	151	0.47	0.37
Puerto Rico	NA	NA	77	29	48	0.62	39	0.69	NA
Rhode Island	>95	85-89	64	43	45	0.70	45	0.93	0.71
South Carolina	90-95	U	201	98	44	0.22	22	NA	NA
South Dakota	NA	NA	26	11	NA	NA	NA	NA	NA
Tennessee	U	U	218	104	131	0.60	115	0.99	0.93
Texas	<80	<80	1141	711	521	0.46	444	0.91	0.72
Utah	90-95	<80	109	65	28	0.26	28	1.00	0.89
Vermont	>95	>95	15	6	0	0.00	NA	NA	NA
Virginia	U	U	460	293	67	0.15	67	0.99	0.72
Washington	U	U	433	309	200	0.46	203	0.99	0.29
Washington D.C	90-95	80-84	71	40	95	1.34	49	0.55	0.45
W. Virginia	U	U	40	15	3	0.08	3	0.67	0.67
Wisconsin	90-95	90-95	272	170	138	0.51	135	0.93	0.9
Wyoming	NA	NA	14	6	NA	NA	NA	NA	NA
U.S.			19155	12914	7627	0.40	7498	0.83	0.75

U = Unknown
NA = Not available

natal HBV infections prevented with a high degree of certainty.

There are several reasons why projects did not identify the majority of HBsAg-positive births in the United States including: 1) at the time of the survey, many program coordinators did not track pregnant women who received services from private providers; 2) several states were just implementing perinatal programs in 1993, and; 3) there may be considerable variation in the prevalence of chronic HBV infection among different ethnic groups by state. For example, a state with a large number of births to foreign-born Asian women from Japan (where the HBsAg prevalence is 2%) may report a much lower number of HBsAg-positive births than a state with a high percentage of births to women from Southeast Asia (where HBsAg prevalence is 10%). In addition, there may be variability in the prevalence of HBsAg among women of other ethnic / racial groups in different parts of the country. For example, a study from New York state suggests that the prevalence of HBsAg among white women in New York is 0.07% (approximately half the prevalence that has been observed in NHANES) (6).

Population-based serological surveys: NHANES has been used to determine the prevalence of HBV infection in the U.S. In NHANES II (1976-1980), children as young as 6 months of age were tested, while in NHANES III (1989-1992) 6-year-olds were the youngest age-group tested. Because the prevalence of HBV infection is low among 1- to 2-year-old children and the sample size of NHANES is limited, future NHANES surveys will not provide a reliable measure of perinatal program effectiveness.

Surveillance for acute hepatitis B: Given the natural history of perinatal HBV infection, few symptomatic cases would be expected to be reported to NNDSS. Over the past 10 years, approximately 300 children 5 years of age were reported annually; however, only 10% of these cases were reported to the Viral Hepatitis Surveillance Program (VHSP). The lack of epidemiologic data makes it difficult to interpret disease trends in this age-group (see Table4).

However, surveillance for perinatal HBV infection could become a part of the VHSP. Postvaccination testing of infants born to HBsAg-positive mothers provides “sentinel surveillance” for the effectiveness of the program. Review of the immunization history of infants found to be HBsAg positive provides ongoing quality control of the program with respect to “on time vaccination”. CSTE has changed the case definition of acute HBV infection to include perinatal HBV infections.

Routine infant vaccination

Vaccination coverage data combined with serologic surveys will provide the best indicator of program effectiveness.

Coverage surveys: Hepatitis B vaccination coverage has been included in the National Immunization Survey conducted by the National Immunization Program. The dose-specific ratio of diphtheria-tetanus-pertussis (DTP) to hepatitis B vaccine delivered can be determined for state immunization projects and selected immunization projects that are IAP grantees. Provider-based assessments can provide hepatitis B vaccination coverage by practice type and provider specialty. Infant hepatitis B vaccination coverage data should be used to ensure high coverage in ethnically defined populations with high rates of early childhood HBV infection.

Table 4. Cases of hepatitis B in children and adolescents reported to CDC surveillance systems, 1983-93

	Age Group								
	< 5 yr			5-10			11-19		
Year	NNDSS*	VHSP†§	VHSP/NNDSS	NNDSS	VHSP	VHSP/NNDSS	NNDSS	VHSP	VHSP/NNDSS
			%			%			%
1983	312	90	29	147	78	53	2374	950	40
1984	228	69	30	141	56	40	2603	953	37
1985	273	61	22	149	45	30	2498	1100	44
1986	279	71	25	140	52	37	2552	1099	43
1987	435	47	11	181	57	32	2388	987	41
1988	353	48	14	144	54	38	1978	935	47
1989	322	56	17	151	71	47	2143	966	45
1990	316	30	10	141	30	21	1879	560	30
1991	220	23	11	130	27	21	1594	491	31
1992	228	26	11	106	24	23	1398	413	30
1993	133	12	9	114	24	27	983	377	38

* National Notifiable Diseases Surveillance System
† Viral Hepatitis Surveillance System
§ Meeting case definition

Population-based serological surveys: Because few children with acute HBV infection develop symptomatic disease, serologic surveillance provides the best measure of program effectiveness in preventing early childhood HBV infection. In NHANES II, serologic testing of children 6 months to 5 years of age detected a low prevalence of HBV infection in blacks and whites (1.29% and 0.33%, respectively), but among Asian children born in the US, the rate of infection was 6.3%. While the prevalence of HBV infection may be too low to detect an important difference in the prevalence of HBV infection among blacks and whites, a reduction in the prevalence of HBV infection among Asian children should be detected in NHANES IV. In addition, special serologic surveys in populations with previously defined high rates of early childhood HBV infection (i.e., Alaskan Eskimos, Pacific Islanders, Hawaiian school children) will continue to confirm the long-term effectiveness of routine infant vaccination (7-10).

Surveillance for acute hepatitis B: Given the natural history of early childhood HBV infection, few symptomatic cases would be expected to be reported to NNDSS. Over the past 10 years, fewer than 500 children <10 years of age have been reported annually. Only 20% of these cases are reported to the VHSP, and the lack of epidemiologic data makes it difficult to interpret disease trends in this age-group (Table4). Overall, it is strongly encouraged that all cases of hepatitis B in children be reported using the VHSP case report form. Only after more complete reporting occurs can the utility of disease surveillance be ascertained for monitoring disease reduction.

Vaccination of children of immigrant mothers

Specific goals for "catch-up" vaccination of children of immigrant mothers have not been established. However, serologic surveillance could be an effective means to determine the effectiveness of vaccination in these populations since they are not adequately represented in surveys to determine general vaccination coverage.

Coverage data: Special coverage surveys would be required to monitor the level of catch-up immunization in these populations and to estimate its effect on preventing early childhood HBV infections.

Population-based serological surveys: Data from NHANES II and NHANES III has shown that the prevalence of HBV infection is at least six times greater in US-born Asian women than in blacks or whites. Thus, sequential monitoring of age-specific HBV infection rates in the appropriate ethnic/racial groups will provide the best measure of the effectiveness of catch-up hepatitis B vaccination. In addition, special studies will be used to monitor catch-up vaccination efforts for children living in Asian/Pacific Islander communities (10).

Surveillance for acute hepatitis B: Current reported cases of hepatitis B in children 10 years of age do not reliably reflect the rate of HBV infection in this age-group. All cases of hepatitis B in children should be reported to NNDSS and VHSP. Once more complete reporting occurs, the utility of disease surveillance for monitoring disease reduction can be ascertained for this age-group. However, the disproportionately high rate of reported disease for Asian children can be used as an indicator of the effectiveness of this catch-up immunization effort (Table 5).

Table 5. Epidemiologic characteristics of cases of hepatitis B in children and adolescents reported to VHSP, 1983-93

	Age-group (years)					
	<5		5-10		11-19	
Race/ethnicity	**No.**	**%**	**No.**	**%**	**No.**	**%**
White, non-Hispanic	235	(47)	231	(47)	4981	(60)
Black, non-Hispanic	152	(30)	135	(28)	2309	(28)
Hispanic	27	(5)	40	(8)	553	(7)
Asian/Pacific Islander	85	(17)	75	(15)	250	(3)
American Indian/Alaska Native	5	(1)	9	(2)	126	(2)
Source of Infection (mutually exclusive groups)						
Transfusion/blood product	18	(4)	17	(4)	72	(0.9)
Dialysis	2	(0.4)	0		6	(0.1)
Non-sexual contact of confirmed case	212	(46)	120	(27)	1141	(14)
Sexual contact/multiple partners	0		0		460	(6)
Homosexual contact	0		0		262	(3)
Injection drug use	0		0		885	(11)
Occupational exposure	0		0		131	(2)
Other percutaneous exposure	1	(0.2)	0		11	(0.1)
Unknown	224	(49)	315	(70)	5314	(64)

Vaccination of adolescents

Specific disease reduction goals for the vaccination of adolescents have not been established. However, because most HBV infections in this group are symptomatic, specific disease surveillance and vaccination coverage will be the best means to monitor the effectiveness of adolescent hepatitis B vaccination.

Coverage data: At a meeting of hepatitis B program coordinators in Atlanta, a tentative goal for vaccination of adolescents was established. The group suggested that 70% of 14 year old children (or whatever cohort is measured) should have received 3 doses of hepatitis B vaccine by the year 2000. Beginning in 1996, the National Health Interview Survey will provide vaccination coverage data on a national sample of adolescents. This data will be extremely useful in measuring progress in achieving comprehensive vaccination coverage in adolescents for a number of vaccine antigens including hepatitis B.

Vaccination coverage data obtained in other settings serving high risk adolescents (i.e., clinics for sexually transmitted diseases, drug treatment centers) is needed to determine the degree to which these groups have been vaccinated against HBV. However, this surveillance method is not expected to reliably predict or monitor disease reduction.

Population-based serological surveys: Data from NHANES II and NHANES III has shown that the age-specific prevalence of HBV infection increases significantly among teenagers. While it is not known the degree to which adolescent vaccination will lower the prevalence of HBV infection, it is not clear at this time whether seroprevalence data will provide a useful indicator of disease reduction.

Surveillance for acute hepatitis B: Surveillance for acute hepatitis B is possibly the best means of monitoring the effectiveness of any aspect of adolescent immunization since a large proportion of HBV infections in this age-group are symptomatic. In contrast to adults, the male-to-female ratio in this age-group is almost equal and suggests the greater importance of sexually transmitted infections. While approximately 1,500 cases of hepatitis B in this age-group have been reported to the NNDSS annually over the past 10 years, only 30% were reported to VHSP. It is strongly encouraged that all cases of hepatitis B in teenagers be reported using the VHSP case report form. Only after more complete reporting occurs can the utility of disease surveillance be ascertained for monitoring disease reduction. Since program implementation, hepatitis B vaccination coverage has increased rapidly and was estimated to be 58% for 19-24 month old children in the 4th quarter of 1994.

References

1. Stevens CE, Toy PT, Tong MJ, et al. Perinatal hepatitis B virus transmission in the United States. Prevention by passive-active immunization. JAMA 1985:253;1740-45.
2. Friedman SM, De Silva LP, Fox HE, Bernard G. Hepatitis B screening in a New York City obstetric service. Am J Public Health 1988:78;308-10.
3. Klontz KC: A program to provide hepatitis B immunoprophylaxis to infants born to HBsAg-positive Asian and Pacific Island women. West J Med 1987:146;195-99.
4. Wong DC, Purcell RH, Rosen L: Prevalence of antibody to hepatitis A and hepatitis B viruses in selected populations in the South Pacific. Am J Epidemiol 1979:110;227-36.
5. McQuillan GM, Townsend TR, Johannes CB et al. Prevention of perinatal transmission of hepatitis B virus: The sensitivity, specificity, and predictive value of the recommended screening questions to detect high-risk women in an obstetric population. Am J Epidemiol 1987:126:484-491.
6. Ikeda RM, Birkhead GS, Flynn MK, Thompson SF, Morse DL. Use of multiple reporting sources for perinatal hepatitis B surveillance and follow-up. Am J Epidemiol 1995:142;765-770.
7. Wainwright, McMahon BJ, Bulkow LR, Parkinson AJ, Harpster AP, Hadler SC. Duration of Immunogenicity and Efficacy of Hepatitis B Vaccine in a Yupik Eskimo Population-Preliminary Results of an 8-Year Study. Prevention of Viral Hepatitis. In Hollinger FB. ed. Viral Hepatitis and Liver Disease. Baltimore:Williams and Wilkins; 1991:762-765.
8. Stevens CE, Toy PT, Taylor PE, Lee T, Yip HY. Prospects for control of hepatitis B virus infection: implications of childhood vaccination and long term protection. Pediatrics (supplement) 90:1992;170-73.
9. Mahoney FJ, Woodruff BA, Erben JJ, et al Effect of hepatitis B vaccination program on the prevalence of hepatitis B virus infection. JID 1993;167:203-7.
10. Mahoney FJ, Lawrence M, McFarland L, Scott C, Le Q, Farley T. Continuing transmission of hepatitis B virus infection among US-born Southeast Asian children. Pediatrics:1995;96:1113-1116.

Trends Based on Reporting to the National Notifiable Diseases Surveillance System, 1993

From 1992 to 1993, the National Notifiable Diseases Surveillance System (NNDSS) reported an overall reduction of 7% in the reported incidence rate for all types of viral hepatitis combined (Table 1 and Figure 1), and the total case count was at its lowest level in 26 years. Although total cases of hepatitis A actually increased modestly, there were substantial decreases in the total case counts for hepatitis B (down 17% from 1992) and hepatitis C / non-A, non-B (NANB) hepatitis (down 20%). The increase in reported cases of hepatitis C/NANB hepatitis for the years 1990 through 1992 appeared to be largely due to the reporting of anti-HCV-positive persons identified by routine screening who did not have acute hepatitis. This increase was not observed in 1993.

Table 1. Reported Cases of Viral Hepatitis, by Type and Year, United States, 1966-93

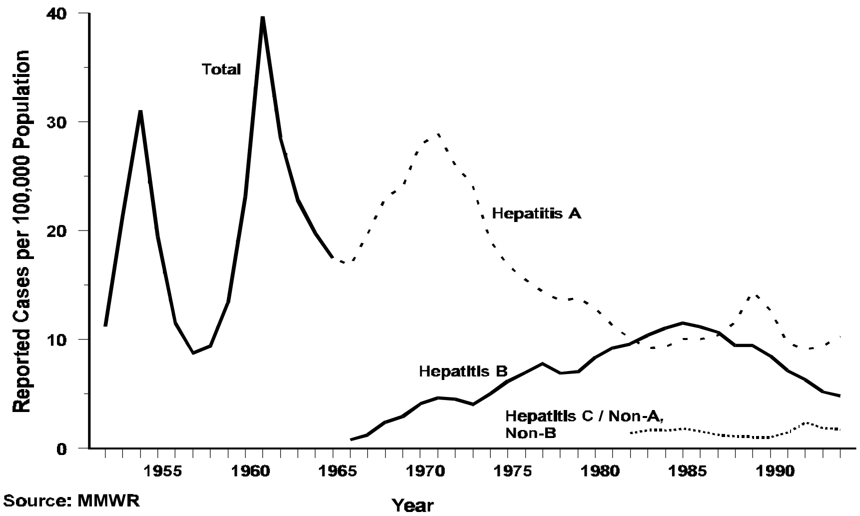
	Types of Hepatitis									
	Hepatitis A		Hepatitis B		Non-A, Non-B		Unspecified		Total	
Year	No.	Rate*	No.	Rate	No.	Rate	No.	Rate	No.	Rate
1966	32,859	16.77	1,497	0.79	†	†	§	§	34,356	17.56
1967	38,909	19.67	2,458	1.28	†	†	§	§	41,367	20.95
1968	45,893	22.96	4,829	2.49	†	†	§	§	50,722	25.45
1969	48,416	23.98	5,909	3.02	†	†	§	§	54,325	27.00
1970	56,797	27.87	8,310	4.08	†	†	§	§	65,107	31.95
1971	59,606	28.90	9,556	4.74	†	†	§	§	69,162	33.64
1972	54,074	25.97	9,402	4.52	†	†	§	§	63,476	30.49
1973	50,749	24.18	8,451	4.03	†	†	§	§	59,200	28.21
1974	40,358	19.54	10,631	5.15	†	†	8,351	3.95	59,340	28.07
1975	35,855	16.82	13,121	6.30	†	†	7,158	3.44	56,134	26.34
1976	33,288	15.51	14,973	7.14	†	†	7,488	3.57	55,749	25.97
1977	31,153	14.40	16,831	7.78	†	†	8,639	3.99	56,623	26.17
1978	29,500	13.53	15,016	6.89	†	†	8,776	4.02	53,292	24.44
1979	30,407	13.82	15,452	7.02	†	†	10,524	4.79	56,393	25.62
1980	29,087	12.84	19,015	8.39	†	†	11,894	5.25	59,996	26.49
1981	25,802	11.25	21,152	9.22	†	†	10,975	4.79	57,929	25.26
1982	23,403	10.11	22,177	9.58	2,629	1.14	8,564	3.40	56,773	24.52
1983	21,532	9.20	24,318	10.39	3,470	1.48	7,149	3.05	56,469	24.12
1984	22,040	9.33	26,115	11.06	3,871	1.64	5,531	2.34	57,557	24.37
1985	23,257	10.04	26,654	11.51	4,192	1.81	5,530	2.39	59,633	25.76
1986	23,430	10.02	26,107	11.17	3,634	1.55	3,940	1.69	57,111	24.43
1987	25,280	10.39	25,916	10.65	2,999	1.23	3,102	1.27	57,297	23.54
1988	28,507	11.59	23,177	9.42	2,619	1.07	2,470	1.00	56,773	23.10
1989	35,821	14.43	23,419	9.43	2,529	1.02	2,306	0.93	64,075	25.81
1990	31,441	12.64	21,102	8.48	2,553	1.03	1,671	0.67	56,767	22.81
1991	24,378	9.67	18,003	7.14	3,582	1.42	1,260	0.50	47,223	18.73
1992	23,112	9.06	16,126	6.32	6,010	2.36	884	0.35	46,132	18.09
1993	24,238	9.39	13,361	5.18	4,786	1.86	627	0.24	43,012	16.68

* Rate per 100,000 population
† Not reported until 1982
§ Not reported until 1974

Hepatitis A

The most recent peak in the incidence of hepatitis A occurred in 1989, when almost 36,000 cases were reported to the NNDSS (Table 1). As in previous years when epidemics of hepatitis A swept the nation, the peak in 1989 was followed by rapid reductions in reported case levels. In 1993, the case count began increasing again, up 5% over the 1992 level. Although peaks in incidence of hepatitis A exhibited a 7- to 10-year recurrent pattern during 1954-1971, a subsequent peak (albeit much smaller) was not observed until 1989 (Figure 1). Data from outbreak investigations conducted as early as 1983 in Oregon (1) and from 1986 through 1987 in other areas of the country indicated that injection drug users were involved in an increasing number of outbreaks (2,3). Although the number of hepatitis A cases associated with injection drug use peaked in 1989, contact with another hepatitis patient and day-care attendance continued to be the most frequent risk factors reported.

Figure 1. Viral Hepatitis by Year, United States, 1952-93



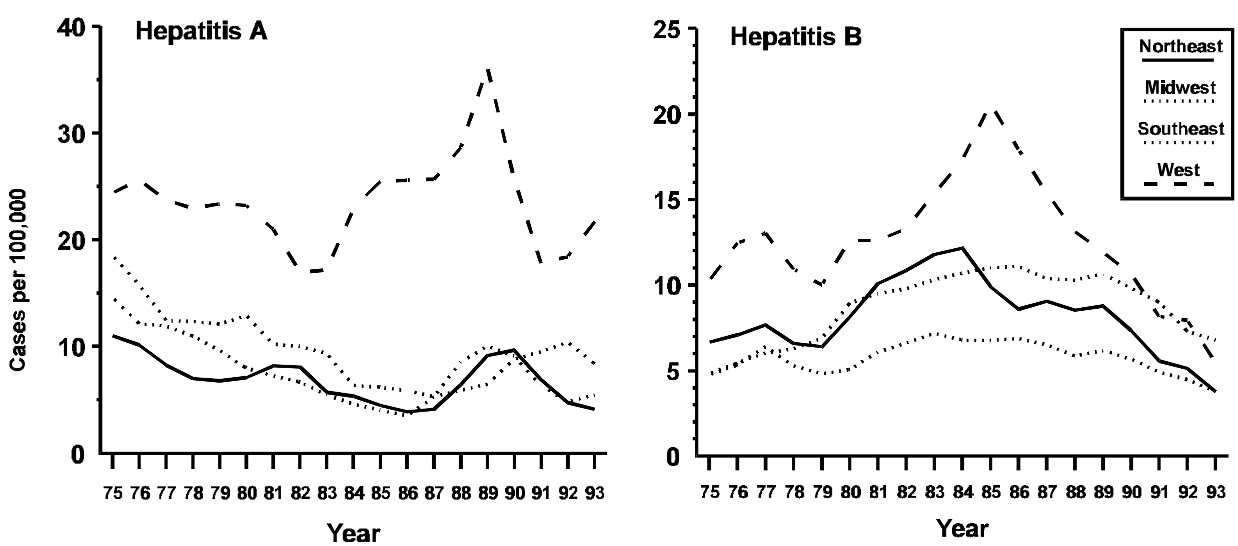
Source: MMWR

Trends in hepatitis A varied by region (Figure 2). In the West, the incidence of hepatitis A reached a peak in 1989 and the increase observed nationwide during 1992-1993 has primarily been focused in this region. The Southeast had a slight increase in incidence in 1993. In the Northeast, the incidence continued declining in 1993, and in the Midwest, hepatitis A incidence reached a peak in 1992 and declined in 1993.

Analysis of risk factors from the Viral Hepatitis Surveillance Program (VHSP) suggests that cases resulting from person-to-person contact reached their highest levels for all regions in 1989. In that year, the western states reported proportionately more cases attributable to day-care-related exposures and foodborne outbreaks than did other regions. In general, however, the regions did not differ substantially with respect to the distribution of risk factors.

Incidence rates for hepatitis A in 1993 were plotted by county for the United States (Figure 3A). The West

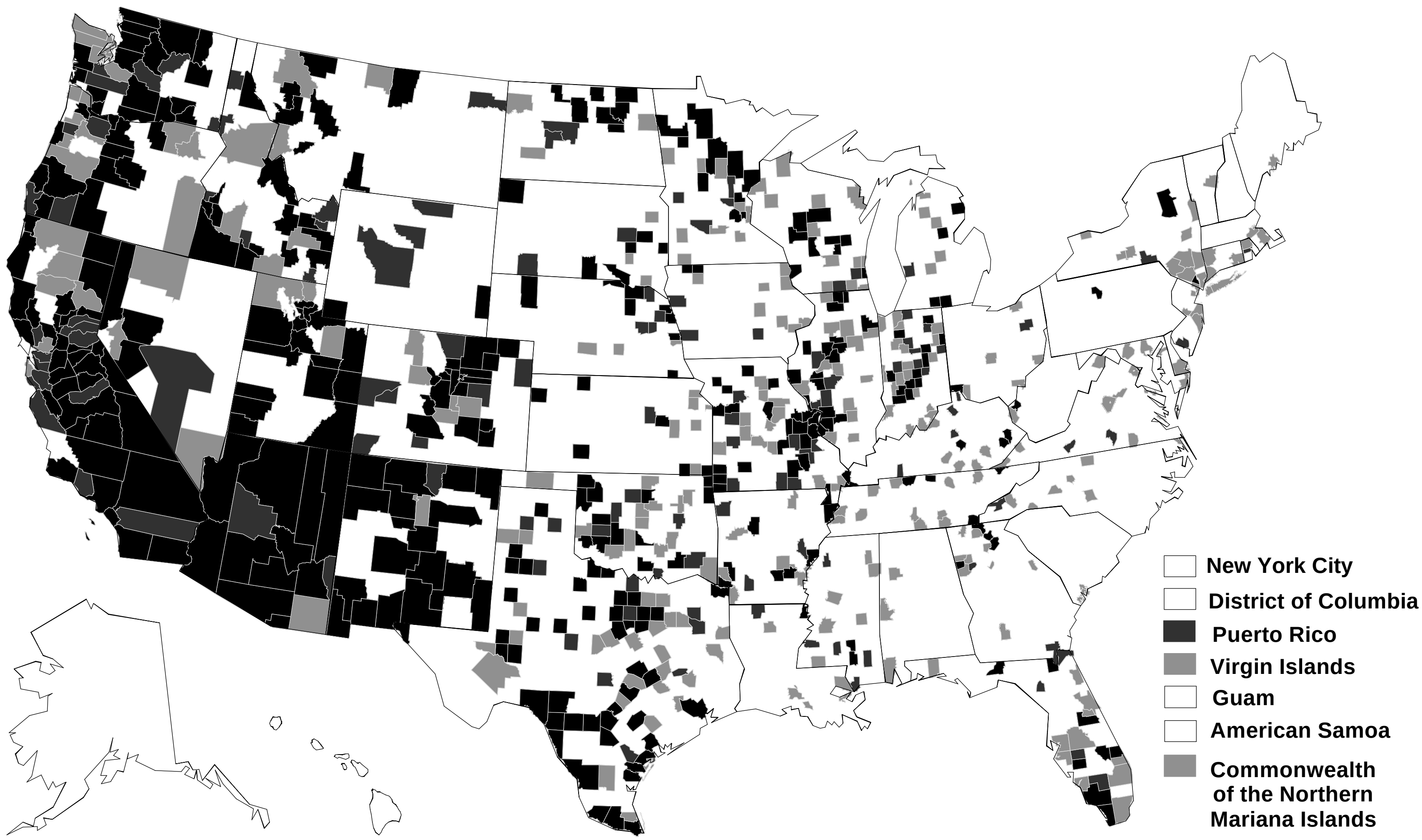
Figure 2. Reported cases of hepatitis A and B, by region, United States, 1975-93



For 1985 and 1986, excludes cases from New York; data not available

Source: MMWR

Figure 3A. Reported Cases of Hepatitis A per 100,000 Population, United States, 1993



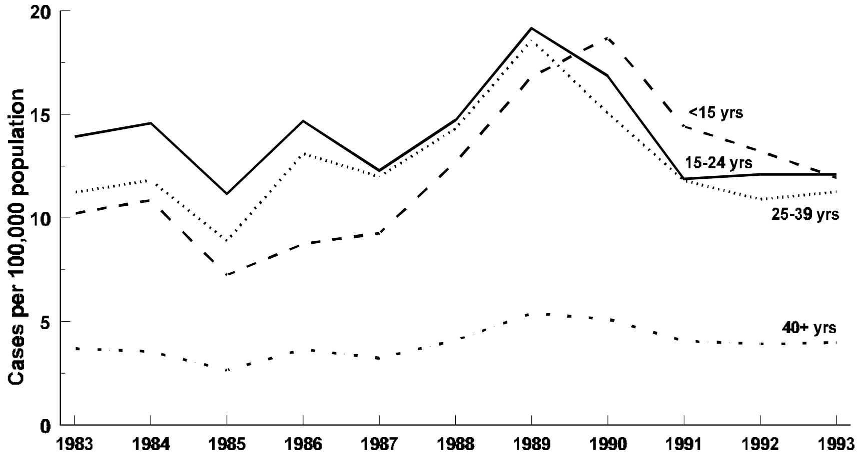
Rate per 100,000

No cases	4.0 - < 8.0
8.0 - < 12.0	12.0 +

Source: MMWR

had the highest proportion of counties with moderate-to-high rates of hepatitis A (8 to 12 or more cases per 100,000 population). High rates of hepatitis A were observed in a moderate number of counties in the Midwest (west north-central and east north-central regions) and a smaller number of counties in the south Atlantic, east south-central, and west south-central regions. In the West the higher incidence rates were closely correlated with demographic factors, e.g., counties with 10% or more of the population classified as American Indian had average rates 3.5 times higher than counties with less than 10% of the population so classified. Similarly, counties with 15% or more of the population classified as Hispanic had average rates 2.1 times higher than counties with less than 15% of the population so classified (2). County-specific rates require care in interpretation since counties in the West are much larger and not as numerous as counties in the Midwest and East. Population density must also be taken into account when comparing regional rates to ensure that the total case numbers of the larger western counties are not misinterpreted.

Figure 4A. Reported Cases of Hepatitis A, by Age, United States, 1983-93*



*For 1985, excludes cases from New York City; data not available.
Source: MMWR

During 1983-1993, trends in incidence rates of hepatitis A were similar for all age-groups (Figure4A). However, persons 40 years old and older had rates less than half of those for younger persons. After peaking in 1989, the incidence of hepatitis A decreased among persons 15 years old and older, and then remained unchanged since 1990. For those less than 15 years of age, a peak occurred in 1990, and has declined since then.

Hepatitis B

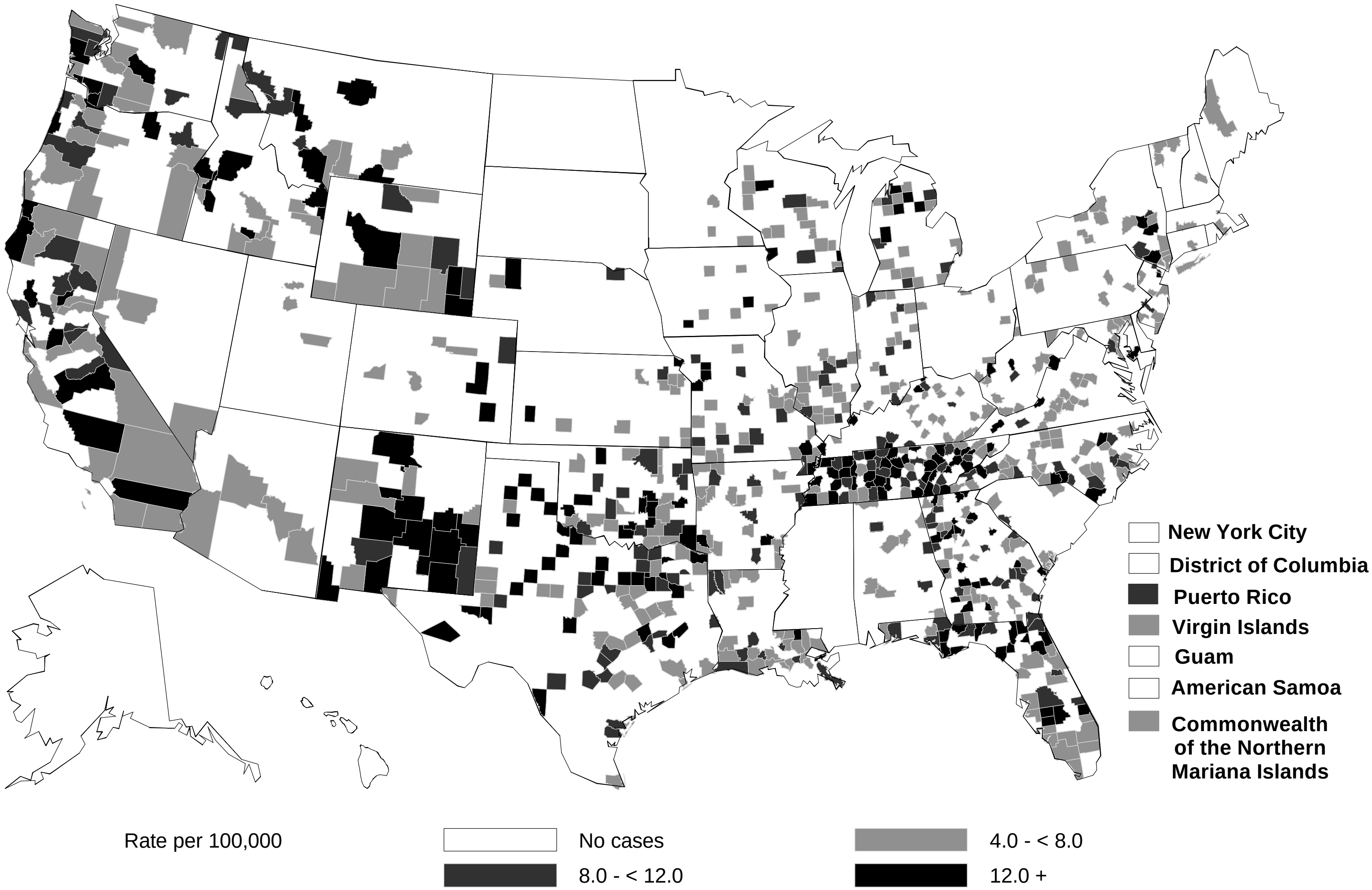
Since 1985, the incidence rate of hepatitis B has declined by 55% (Figure 1) to a level close to that reported in 1975 (Figure 1 and Table 1). Some of the increase in hepatitis B incidence during 1966-1985 was attributable to improvements in serologic diagnosis, and some of the decrease in incidence in recent years may be due to changes in state reporting practices, i.e., the case definition published by CDC and the Council of State and Territorial Epidemiologists in 1990 had not been uniformly adopted by all states. As states have adopted the CDC case definition, or changed the definition being used, large variations in reported cases of hepatitis B have been observed from some states during the last 3 years (4,5). State offices were contacted after they reported changes in hepatitis B incidence of over 200% from the previous year. Each office contacted confirmed that changes in their use of case definitions or changes in the reporting of confirmed vs suspected cases accounted for the unusual increase or decrease.

Despite these artifacts, there has been a significant, prolonged decline in the incidence of hepatitis B in the United States. Thirty-eight states reported decreases, averaging 27% over 1992-93; however, 14 states reported increases in the incidence of hepatitis B from 1992 to 1993, with an average percentage increase of 19%. Regionally, hepatitis B incidence has been higher and has shown wider variations over time in the West than in the other regions (Figure 2). Each of the four regions reported increases in incidence until the mid-1980s. By 1993, the rate in each region had declined, with the Southeast having the highest rate and the Northeast the lowest. As shown in Figure 2, the incidence rates for all of the regions have become more nearly equal.

County-specific incidence rates for hepatitis B demonstrate the sporadic distribution of cases in the United States (Figure 3B). High rate counties can be found in each region and with few exceptions in each state. Comparison of county rates should take into account population density as well as geographic size.

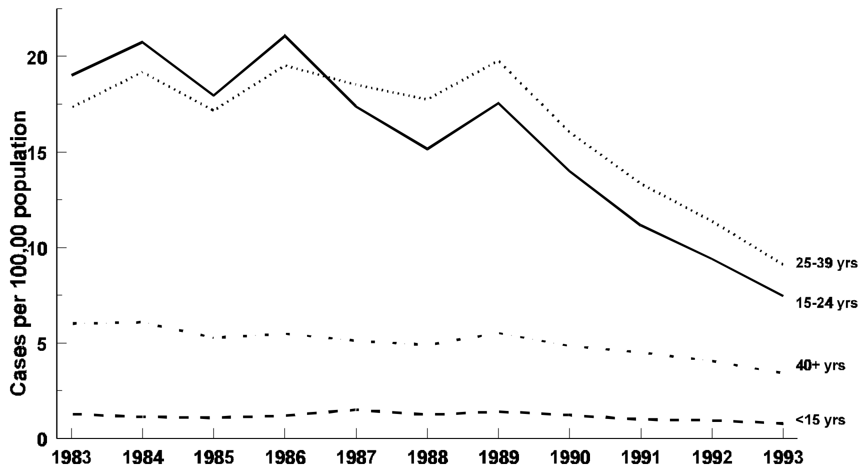
Age-specific incidence rates for hepatitis B have declined since 1985 (Figure 4B). The highest rates by age were among 15- to 24-year-olds until 1987, and among 25- to 39-year-olds from 1987 to the present. Although rates have dropped by 50% for these two age-groups since 1985, they have remained relatively stable for persons aged 40 and older during this period. In 1993, rates among 0- to 14-year-olds dropped by less than 4%.

Figure 3B. Reported Cases of Hepatitis B per 100,000 Population, United States, 1993



Source: MMWR

Figure 4B. Reported Cases of Hepatitis B, by Age, United States, 1983-93*



*For 1985, excludes cases from New York City; data not available.
Source: MMWR

Non-A, Non-B Hepatitis

In 1989, the NNDSS reported an incidence rate of 1.02 cases of NANB hepatitis per 100,000 population. From 1990 through 1992, the NNDSS reported that the incidence of NANB hepatitis more than doubled (Table 1). In 1993, the rate dropped by 21% to 1.86 cases per 100,000. This decline is consistent with trends observed in the Sentinel Counties study, where the incidence rate of reported NANB hepatitis has declined by 80% since 1989. This discrepancy between the two surveillance systems can be attributed to an artifactual increase in the number of cases reported to NNDSS as a result of persons being screened by blood banks and others for antibody to the hepatitis C virus (anti-HCV). In some states, laboratory reports of anti-HCV positivity in the absence of confirmation of acute clinical disease are accepted as case reports of NANB hepatitis, leading to the artifactual changes in the reported incidence of this disease. Persons who may test positive for anti-HCV include not only those with acute symptomatic hepatitis C, but also persons with past and chronic HCV infections, and persons with no viral hepatitis infections (false positives).

For all cases of suspected viral hepatitis, CDC recommends 1) using case definitions agreed upon by the Council of State and Territorial Epidemiologists and CDC, 2) diagnosing cases on the basis of both clinical and serologic evidence, and 3) reporting only serologically confirmed cases to CDC, including hepatitis C/NANB hepatitis diagnosed by exclusion of hepatitis A and B.

In April 1995, the NNDSS changed the category heading for viral hepatitis in Table II of the MMWR to reflect these reporting changes. Cases reported as hepatitis C or as hepatitis NANB are now combined in Table II as hepatitis C/NANB. Some patients with hepatitis C may continue to present as NANB cases, since an average of 20% of patients with acute hepatitis C will not have developed anti-HCV (as determined by the second-generation enzyme immunoassay by 5 to 6 weeks after onset of their hepatitis (6,7). In addition, these tests may not detect any anti-HCV in approximately 10% of patients infected with HCV, or anti-HCV testing may not have been performed.

References

1. Shade CP, Komorwska D. Continuing outbreak of hepatitis A linked with intravenous drug abuse in Multnomah County. Public Health Rep 1988; 103:452-9.
2. Shapiro CN, Shaw FE, Mandel EJ, et al. Epidemiology of hepatitis A in the United States. In: Hollinger FB, Lemon SM, Margolis H, eds. Viral hepatitis and liver disease. Baltimore: Williams & Wilkins, 1991;71-6.
3. Centers for Disease Control and Prevention. Hepatitis A among drug abusers. MMWR 1988;37:298-300,305.
4. Centers for Disease Control and Prevention. Case definitions for public health surveillance. MMWR 1990;39(No. RR-13):17.
5. Centers for Disease Control and Prevention. Summary of notifiable diseases, 1992. MMWR 1993;42(SS-3).
6. Alter MJ, Margolis HS, Krawczynski K, et al. The natural history of community-acquired hepatitis C in the United States. N Engl J Med 1992;327:1899-1905.
7. Alter MJ. The detection, transmission, and outcome of hepatitis C virus infection. Infectious Agents and Disease 1993;2:155-66.

Viral Hepatitis Surveillance Program, 1993

The total numbers of cases reported to the Viral Hepatitis Surveillance Program (VHSP) are shown in Table 1A. Approximately 36% of hepatitis A cases, 26% of hepatitis B cases, and 18% of NANB hepatitis cases reported to the NNDSS in 1993 were also reported to the VHSP. These percentages reflect a substantial decline in reporting to the VHSP. Reporting to the VHSP remains inconsistent among states, with increasing numbers of states reporting fewer of their NNDSS cases to the VHSP than in previous years (Table 1B). In 1987, six states reported to VHSP less than 15% of their NNDSS cases; in 1993, this trend increased to 12 states.

The agreement between reporting to the NNDSS and to the VHSP does not necessarily measure the completeness of reporting from a particular state, since not all cases may be reported to the NNDSS and the two systems have different reporting criteria. The increasing discrepancy between the two systems has resulted in differences in the relative proportions of types of viral hepatitis reported. Before 1990, the proportions of reported cases by type were similar between the two surveillance systems. Since then, the proportion of hepatitis cases reported as hepatitis A to the two systems have remained similar, but the proportion of cases reported as hepatitis B have been discrepant: 24% to 27% of the total VHSP cases were reported as hepatitis B, compared with 35% to 38% of total cases reported to NNDSS. The VHSP also received reports on smaller proportions of the total number of NANB hepatitis cases (7% to 8% of total cases) than did NNDSS (up to 13% of total cases).

These differences in proportions of cases are partly due to the fact that VHSP excludes cases that do not meet the case definition (VHSP eliminated 15% of reported cases as noncases in 1993). In addition, because of strict adherence to the case definition, VHSP classified a larger proportion of reported cases as nonspecific hepatitis: 15% of cases were classified as hepatitis unspecified by the VHSP during 1993 compared with 1.5% of cases reported to NNDSS. Beginning with data collected in 1995, hepatitis cases that have type unspecified are no longer requested or printed in the MMWR.

The VHSP excludes reported cases that do not meet the case definition for acute viral hepatitis (see "Case Definition" section, page 22), including cases that seem to be due to chronic infections. Some responses to the VHSP questionnaires are incomplete, and the information is insufficient to verify the case as an acute infection, or to confirm the serologic type of hepatitis, even though partial testing may have been done. Cases may also be reported too late to be included in the analysis. The latest date for submitting case reports to the VHSP for the calendar year is March 31 of the following year.

Table 1A. Cases Reported to Viral Hepatitis Surveillance Program Compared with NNDSS, by Type of S ubmission, 1991-93

	Year		
	1991	1992	1993
Reports submitted on Form CDC 53.1 Rev. 8-89 (new form)	18,064	16,433	13,563
Reports submitted on Form CDC 53.1 Rev. 8-84 (old form)	1,772	884	617
Reports submitted electronically as extended NETSS* records	810	961	1,427
Total cases reports submitted to VHSP	20,646	18,278	15,607
Total cases serologically confirmed	19,014	16,916	14,469
Total cases meeting case definition for acute hepatitis	17,094	15,362	13,199
Symptomatic hepatitis A	9,621	9,735	8,643
Symptomatic hepatitis B	5,771	4,411	3,526
Hepatitis A and B co-infection	237	151	174
Symptomatic non-A, non-B hepatitis	1,465	1,065	856
Total cases reported to NNDSS†	47,223	46,132	43,012
Hepatitis A	24,378	23,112	24,238
Hepatitis B	18,003	16,126	13,361
Hepatitis non-A, non-B	3,5822	6,010	4,786
Hepatitis, unspecified	1,260	884	627

* National Electronic Telecommunications System for Surveillance
† National Notifiable Diseases Surveillance System

Case Definition

Epidemiologic data about reported cases of acute viral hepatitis are essential for defining the groups at risk and for monitoring changes in such groups. Since new disease acquisition is the event of interest, chronic infections should not be reported.

In 1990 the VHSP updated the case definition for acute viral hepatitis to include IgM anti-HBc for improved diagnosis of acute hepatitis B, to clarify the reporting of NANB hepatitis, and to include delta hepatitis as a separate diagnostic category. The clinical criteria remain the same: an acute case must include an illness with discrete date of onset, and jaundice or elevated serum aminotransferase levels greater than 2.5 times the upper limit of normal. The serologic criteria used to distinguish the different types of hepatitis were as follows: hepatitis A is defined as IgM anti-HAV-positive (regardless of HBsAg status); hepatitis B as IgM anti-HBc-positive (if done) or HBsAg-positive and IgM anti-HAV-negative (if done); and NANB hepatitis as IgM anti-HAV-negative, and IgM anti-HBc-negative (if done) or HBsAg-negative. Although by 1993 only 55% of reported cases were tested for both hepatitis A and B, 87% had sufficient serologic testing to designate a specific type. Only those patients with a specific serologic diagnosis are included in the following analyses.

Cases are excluded if they do not satisfy the criteria for acute viral hepatitis. Among serologically confirmed cases in 1993, 6% of hepatitis A cases, 13% of hepatitis B cases, and 9% of NANB hepatitis cases were excluded because they failed to meet the case criteria. Compared with hepatitis B patients who fulfilled the criteria for acute hepatitis, more persons with hepatitis B who were asymptomatic or had no date of onset were ≤14 years of age, were Asian / Pacific Islander, were dialysis patients, or had histories of blood transfusions or surgery.

Except for age, NANB hepatitis patients not meeting the case definition showed a similar pattern. Compared with NANB hepatitis patients who fulfilled the criteria for acute hepatitis, more persons with NANB hepatitis who were asymptomatic or had no date of onset were ≤40 years of age, were patients undergoing dialysis, or had histories of surgery. This pattern, as well as that for hepatitis B, is consistent with that for the earlier years. For both hepatitis B and NANB hepatitis, these findings suggest that these persons may have been routinely screened for HBsAg or for antibody to the hepatitis C virus (anti-HCV), and found to be positive without any evidence of acute illness.

Hepatitis A and B coinfections were examined in the 1993 data, and constituted approximately 1% of cases meeting the case definition. These cases displayed no specific clustering or associations with geographic or demographic factors. For purposes of risk factor analysis, these cases were counted twice, and included as hepatitis A cases and hepatitis B cases.

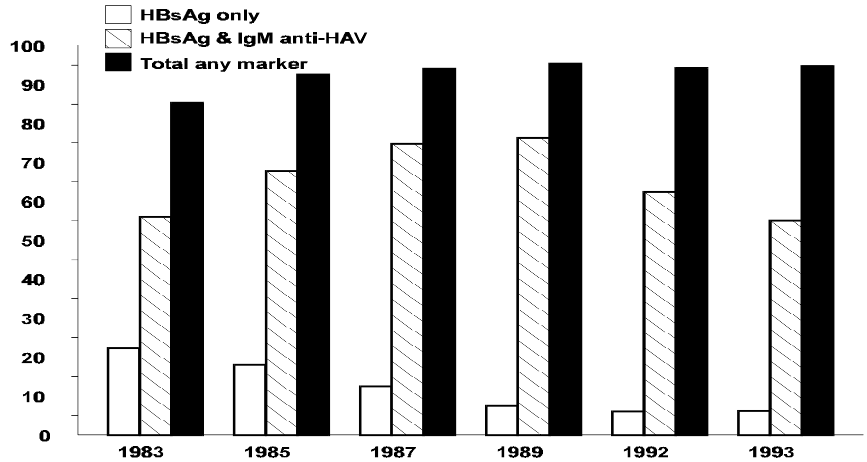
Table 1B. Proportion of NNDSS-Reported Cases Reported to VHSP by States, 1993

75% - 100%	50% - 74%	25% - 49%	15% - 24%	0% - 14%
Alabama	Colorado	New York (excl NYC)	Arizona	Alaska
District of Columbia	Indiana	Rhode Island	Georgia	Arkansas
Delaware	Maine	Wyoming		California
Florida	Massachusetts			Connecticut
Hawaii	Michigan			Idaho
Iowa	Missouri			Kansas
Illinois	New Hampshire			Kentucky
Louisiana	Virginia			Mississippi
Maryland	Washington			Montana
Minnesota	Wisconsin			New Jersey
North Carolina				New Mexico
North Dakota				New York City
Nebraska				Oregon
Nevada				South Carolina
Ohio				South Dakota
Oklahoma				Tennessee
Pennsylvania				Texas
Utah				
Vermont				
West Virginia				

Use of Serologic Tests for Diagnosis

Serologic testing for the diagnosis of hepatitis, beginning with hepatitis B surface antigen (HBsAg) in 1972, immunoglobulin-M antibody to hepatitis A virus (IgM anti-HAV) in 1981, and IgM antibody to hepatitis B core antigen (IgM anti-HBc) in 1984, has been critical in distinguishing the types of viral hepatitis. Serologic testing for any marker using one or more tests has increased from 60% in 1983 to 94% in 1993 (Figure 1). By 1993, only 6% of reported cases were diagnosed on the basis of the HBsAg test alone. However, there has been a decline in the number of cases reported in which testing for both hepatitis A and hepatitis B was done. In 1989, 76% of physicians reported using tests for both types (the highest percentage reached); this declined to 70% in 1990, 68% in 1991, 63% in 1992, and to 55% in 1993. At the same time, the number of cases reported in which testing only for hepatitis A was done increased over this period, from 15% in 1989 to 28% in 1993. The reliance on testing for hepatitis A alone for these cases may be related to the higher incidence of hepatitis A in communitywide outbreaks since 1989.

Figure 1. Serologic Tests to Diagnose Hepatitis, 1983-1993



Source: VHSP, CDC
For 1992-93, HBsAg + IgM anti-HAV + IgM anti-HBc are shown as middle bar.

Demographic Characteristics

Among persons less than 15 years of age, hepatitis A remained the most frequent of the types reported; hepatitis B and NANB hepatitis were reported in small numbers of persons in this age-group (Table 2). The percentage of NANB hepatitis cases among patients 60 years old and older (8.8%) was the highest of the three types. However, most persons who acquire any type of viral hepatitis are between the ages of 20 and 39: approximately 45% of hepatitis A, 63% of hepatitis B, and 61% of NANB hepatitis are reported among persons in this age span.

From 1992 to 1993, the number of hepatitis A cases among patients 20-39 years of age decreased 10%; hepatitis B cases, 21%; and NANB hepatitis cases, 19%. Demographic factors for all types showed patterns consistent with those of previous years (Table 2).

The male-to-female case ratios were similar to previous years: for hepatitis A, the male-to-female ratio was 1.2:1; for hepatitis B, 1.5:1; and for NANB hepatitis, 1.4:1.

Non-Hispanic whites accounted for the majority of all types reported, including 57% of hepatitis A, 54% of hepatitis B, and 65% of NANB hepatitis (Table 2). However, the proportion of each type of hepatitis reported as non-Hispanic white declined. Non-Hispanic blacks in 1993 continued to represent disproportionately higher percentages of hepatitis B, accounting for 31% of all hepatitis B cases. Among black patients with any type of hepatitis, hepatitis A was the predominant type in 1993, accounting for 55% of all cases. This represents a shift from 1989, when 53% of all cases among blacks were hepatitis B cases. Data from a large population-based seroprevalence study confirm that the prevalence of HBV infection is more than four times higher among blacks than among whites (1). The percentage of blacks among NANB hepatitis patients increased from 12% in 1989 to 22% in 1992, but decreased to 18% in 1993. In 1989, Hispanic patients accounted for 9% of reported hepatitis A cases. While this percentage increased to 12% by 1993, the absolute number of Hispanic cases declined, as was true for other racial/ethnic groups. When the percentages of Hispanic cases were examined for both old reporting forms and newly revised forms for the 1990 data, there was no evidence that the coding of ethnicity separately from race affected reporting of such cases.

Analysis of Risk Factor Data

The analysis of epidemiologic data for 1993 took into consideration the changes in both incidence and reporting practices. Reporting was analyzed by groups of states to determine if significant biases existed in the data when reports from all participating states were included for analysis. Criteria for good reporting states ("core" states) included adequate serologic testing of reported cases (at least 80% of reported cases tested for IgM anti-HAV or HBsAg), and reporting to the VHSP

Table 2. Distribution of Viral Hepatitis Types A, B, and Non-A, Non-B, by Age, Sex, and Ethic Grou p, United States, 1993.

Characteristic	Hepatitis A N = 8,817		Hepatitis B N = 3,714		Non-A, Non-B Hepatitis N = 856	
	No.	%	No.	%	No.	%
Age (Years)						
<5	456	5.2	7	0.2	14	1.6
5-9	1,066	12.1	15	0.4	9	1.1
10-14	801	9.1	63	1.7	7	0.8
15-19	778	8.8	276	7.4	38	4.4
20-29	2,207	25.0	1,265	34.1	203	23.7
30-39	1,772	20.1	1,061	28.6	316	36.9
40-49	784	8.9	569	15.3	131	15.3
50-59	385	4.4	230	6.2	54	6.3
60+	513	5.8	195	5.3	75	8.8
Unknown	55	0.6	33	0.9	9	1.1
Sex						
Male	4,742	53.8	2,179	58.7	490	57.2
Female	3,917	44.4	1,478	39.8	349	40.8
Unknown	158	1.8	57	1.5	17	2.0
Race/Ethnicity						
White, non-Hispanic	4,980	56.5	2,010	54.1	553	64.6
Black, non-Hispanic	1,579	17.9	1,140	30.7	155	18.1
Hispanic	1,072	12.2	202	5.4	57	6.7
American Indian or Alaskan Native	385	4.4	51	1.4	24	2.8
Asian or Pacific Islander	186	2.1	76	2.0	17	2.0
Unknown	615	7.0	235	6.3	50	5.8

Source: Viral Hepatitis Surveillance Program

of a high proportion of cases reported to NNDSS (at least 50% of total cases reported to NNDSS also reported to VHSP). In addition, core states were further subdivided into those with rates above the national average for each type, and those with rates below the national average, and comparisons were made between these subgroups. Trends in these core states were then compared to trends in the remaining states for evidence of consistency and potential bias.

For hepatitis A, analysis of the core group of states showed that trends were very similar between the core states and all reporting states, and between the high-rate and low-rate subgroups. In the trend analyses that follow, hepatitis A risk factors were based on reported cases from all reporting states, and trends were analyzed by using absolute numbers of cases. For hepatitis B and C/NANB, a core group of 15 states were selected using the same reporting criteria and high levels of serologic testing for HBV during 1983-1993. These states accounted for approximately 30% of all cases of hepatitis B reported to the VHSP in this period.

For hepatitis B and C/NANB hepatitis, artifactual changes in reporting levels resulted in significant differences between the trends for all VHSP states and the trends in the core states, although there were no differences between high- and low-incidence states. For hepatitis B and hepatitis C/NANB hepatitis, trends in risk factors were analyzed by using absolute numbers of cases from the core states only.

Epidemiologic Characteristics

Table 3 presents crude frequencies of the potential sources of infection reported by patients with viral hepatitis. The same questionnaire was used for all patients with hepatitis, regardless of type. Although questions about selected risk factors associated primarily with hepatitis A have not always been asked for hepatitis B and NANB hepatitis, and vice versa, cases reported in 1993 have shown an improvement in this respect. Patients may also give a positive response to more than one factor; therefore, the data listed in Table3 are not mutually exclusive.

Hepatitis A

Personal contact with a hepatitis A patient continued to be the predominant source of infection among persons with hepatitis A in 1993. The crude frequency that this potential source was reported, 34%, was

Table 3. Crude Frequency of Potential Sources for Acquiring Viral Hepatitis and Other Characteristics, 1993

Characteristic	Percentage of Patients: Hepatitis A N = 8,817	Hepatitis B N = 3,714	Non-A, Non-B Hepatitis N = 856
Reported within 2-6 weeks of illness*			
Child/employee in day-care center	6.8	1.6	1.7
Contact of day-care child/employee	10.9	4.7	5.0
Personal contact with hepatitis A patient	33.6	1.8	3.5
Suspected foodborne or waterborne outbreak	4.7	0.3	0.6
International travel	8.4	3.2	2.4
Reported within 6 weeks to 6 months of illness*			
Blood transfusion	0.4	1.0	2.4
Injection Drug use	3.7	10.5	23.0
Medical/dental employment	2.9	3.5	4.0
Hemodialysis-associated	0.9	1.2	1.5
Personal contact with B/non-A, non-B patient+	3.8	17.7	13.2
Homosexual activity	3.6	6.9	3.5
Multiple sex partners	4.9	20.2	12.5
Dental work	11.1	15.5	16.8
Surgery	3.5	6.6	8.1
Acupuncture	0.5	0.5	0.5
Tattooing	1.8	4.3	5.7
Other percutaneous exposure	0.9	3.2	2.7
Known hepatitis B vaccine responder	NA	0	NA
Ever received hepatitis B vaccine	3.4	NA	3.5

* Approximately 67% to 76% if hepatitis B patients, and 70% to 81% of NANB hepatitis patients answered these questions.
\+ Approximately 60% to 70% of hepatitis A patients answered the non-sexual questions; 46% answered these regarding sexual preferences of number of sex partners; therefore, reported frequencies for these risk factors may be unreliable (see text).

similar to the rates in previous years. Many persons reported two or more potential sources of infection. Of those patients who were associated with day-care centers, 41% also reported personal contact with a hepatitis A patient, and 7% were part of a suspected foodborne or waterborne outbreak. Of those reporting contact with a hepatitis A patient, 6% also reported being part of a suspected foodborne or waterborne outbreak.

Since hepatitis A has an average incubation period of 30 days and is transmitted by the fecal-oral route, the characteristics reported by persons with hepatitis A as having occurred in the 6 weeks to 6 months prior to illness (Table 3) are generally not applicable to transmission of this virus (2). Although homosexual men are considered at increased risk of acquiring hepatitis A (3), the frequency with which homosexual activity was reported by persons with hepatitis A (3.6%) may be understated, since only 46% of the patients were asked the question in 1993. However, this percentage has increased in recent years. The frequency with which injection drug use was reported by patients with hepatitis A may be more reliable than in the past, since over 70% of patients with hepatitis A answered this question in 1993. These improvements lend greater validity to these data than in previous years.

Of patients reporting personal contact with a hepatitis A patient, 10% reported sexual, 45% reported household, and 45% reported other contact. Of those reporting other than sexual or nonsexual household contact, none had reported day-care-related exposures, but 8% reported being a part of a suspected outbreak.

To better define patterns of hepatitis A virus transmission, patients who reported more than one potential source of infection were assigned to only one group on the basis of their most probable source. These mutually exclusive groups are shown in Table 4. Contact with another person with hepatitis A was the risk factor most frequently cited. Association with a day-care center and international travel were the two risk factors next in importance.

The frequency with which the various risk factors were reported was influenced by the age of the patient. Contact with another person with hepatitis A was the most frequently reported risk factor for all age-groups, although the percentage of patients reporting this risk factor decreased with increasing age. For persons less than 15 years old, being a child in a day-care center was the next most frequently reported risk factor. For those aged 15-39, contact with a day-care child or employee was the next most important risk factor. Reporting of injection drug use as a risk factor for hepatitis A

Table 4. Epidemiologic and Clinical characteristics of Patients Reported with Hepatitis A, by Age Gr oup, United States, 1993

Epidemiologic Characteristics for Prior 6 weeks by Mutually Exclusive Groups*	Total N = 8,817+	Percentage of Patients By Age (years) <1-14 N = 2,323	15-39 N = 4,757	40+ N = 1,682
Child/employee in day-care center	6.9	17.2	2.9	2.5
Contact of day-care child/employee	8.6	6.4	11.0	5.1
Personal contact with hepatitis A patient	22.0	29.0	21.8	12.8
Suspected food- or waterborne outbreak	2.2	1.2	2.1	3.9
International travel	6.3	8.2	5.2	6.5
Homosexual activity	4.9	0.2	6.9	3.9
Injection drug use	2.4	0.0	3.8	2.0
Unknown	46.7	37.8	46.3	63.3
Clinical characteristics				
Jaundice	83.0	81.7	85.7	76.9
Hospitalized for hepatitis	18.8	10.6	19.5	29.1
Death as a result of hepatitis	1.7	0.2	2.0	3.2

* In decreasing order of exclusion.
+ Number includes age unknown.

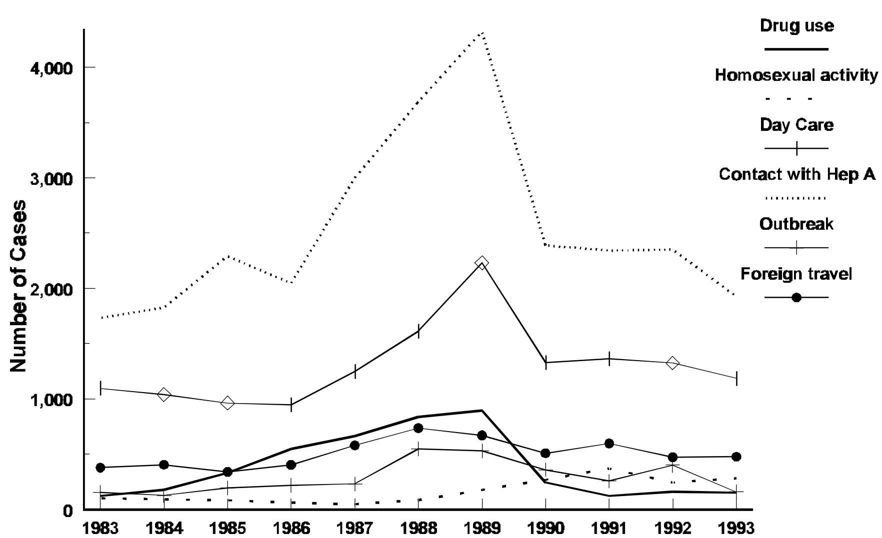
dropped by 1993 to low levels (4%) for this age-group. For persons over 40 years of age, international travel and being a part of a suspected foodborne or waterborne outbreak were the next most frequent risk factors.

International travel was reported in 6% of hepatitis A cases in 1993. South and Central America were the locations visited most frequently (67% of travel-related cases in 1993). Destinations in Asia and the South Pacific were visited next most often (10% of cases in 1993). The duration of stay was 1-3 days in 17% of cases with international travel as a risk factor, 4-7 days in 15%, and more than 7 days in 68%. Among patients reporting short stays (1-3 days), over 90% reported visits to South / Central America.

Race and ethnicity were examined among hepatitis A patients with international travel as a risk factor. Hispanic patients accounted for 47%, non-Hispanic whites accounted for 43%, and Asian / Pacific Islanders for 8% of cases. Non-Hispanic blacks accounted for less than 2% of travel-related cases in 1993. There was an association between race and location visited: 92% of Hispanic patients with travel-related hepatitis A visited South / Central America, while 75% of non-Hispanics did so. Among Asian / Pacific Islander patients, 85% visited Asian / South Pacific destinations, while 0% to 7% of other races or ethnic groups visited these locations.

Because the total number of hepatitis A cases reported has changed over the years, the absolute numbers of cases for each risk factor show more accurately the trends over time for hepatitis A. The numbers of cases associated with personal contact with another hepatitis A patient during 1983-1993 have exhibited the greatest variation (Figure 2), with an increase of over 100% occurring from 1983 to 1989, followed by a comparable decrease from 1989 to 1993. Day-care-related cases increased more slowly during this period, but

Figure 2. Trends in Selected Risk Factors for Patients Reported with Hepatitis A by Mutually Exclusive Groups, United States, 1993



Source: Viral Hepatitis Surveillance Program, CDC.

peaked in 1989 also, followed by a drop of 47%. The numbers of cases attributable to drug use increased steadily between 1983 and 1989, and declined rapidly to their present low level. Cases related to homosexual activity remained at low levels from 1983 through 1987. By 1989, however, there was a 3.6-fold increase in cases of hepatitis A among homosexual men, and outbreaks of hepatitis A in this population subgroup were reported. Cases among homosexual men have remained at higher levels through 1993. Foreign travel and foodborne outbreak-associated cases peaked in 1988 and declined overall since then.

Jaundice characterized an average of 85% of the reported hepatitis A cases in 1993. Although this frequency was similar across age-groups, jaundice and other symptoms are uncommon among young children infected with hepatitis A virus. Thus, reported cases substantially underestimate the infection burden among the youngest age-group. The rate of hospitalization of patients with hepatitis A has remained steady in 1993, and continues to increase with increasing age. The case-fatality rate for hepatitis A patients also increased with age, and showed a slight increase with time as well for those aged 15 and over in 1993.

Hepatitis B

Based on crude frequencies of reported risk factors, contact with another hepatitis B patient, injection drug use, and having multiple sex partners were the three most frequently reported potential sources of infection for hepatitis B patients in 1993 (Table 3). In 1993, having multiple sex partners was the most frequent potential source of infection reported. Homosexual preference was reported by 7% of hepatitis B patients during 1993. As with other types of hepatitis, several possible sources of infection were often reported for the same patient.

Seventy-two percent of the persons with hepatitis B were asked about potential risk factors commonly associated with hepatitis A that occurred within the 2 to 6 weeks prior to illness. Although these factors are generally not associated with the transmission of HBV because the incubation period is too short, health-care workers interviewing patients with hepatitis are encouraged to obtain from each patient information on all types of risk factors, both to detect newly emerging problems (as occurred with injection drug use and hepatitis A) and to ensure a complete exposure history when cases are serologically classified.

Events or conditions reported within the 6 months prior to hepatitis B illness — such as history of dental work, surgery, acupuncture, tattooing, or other percutaneous exposures — are not considered likely sources of sporadic infection, but are primarily useful in identifying clusters of cases at the local level.

Of three patients reported with acute hepatitis B and evidence of having responded to the hepatitis B vaccine, all three were also reported to have coinfections with acute hepatitis A. After follow-up with the reporting health department, none of these cases were found to be true candidates for breakthrough infections.

Persons who reported multiple risk factors for hepatitis B were assigned to mutually exclusive groups (2, 4-6) (Table 5). As a percentage of all cases, being heterosexually active with multiple partners has replaced injection drug use as the predominant risk factor for acquisition of hepatitis B. Personal contact with another hepatitis B patient was the third most common risk factor. Of personal contacts in 1993, 68% were sexual, and 17% were nonsexual household contacts. The remaining 15% of personal contacts, classified as “other”, are unclear as to specific sources because information

Table 5. Epidemiologic and Clinical characteristics of Patients Reported with Hepatitis B, by Age Gro up, United States, 1993

	Percentage of Patients By Age (years)			
Epidemiologic Characteristics for Prior 6 weeks by Mutually Exclusive Groups*	**Total N = 3,714+**	**<1-14 N = 85**	**15-39 N = 2,602**	**40+ N = 994**
Injection drug use	10.5	0.0	12.3	6.8
Homosexual activity	9.4	0.0	10.6	6.7
Employed in medical/dental field	3.1	0.0	3.0	3.7
Hemodialysis	0.4	1.2	0.2	0.7
Personal contact with hepatitis B patient	8.3	25.9	8.3	6.6
Multiple sex partners	12.2	5.9	14.4	7.1
Blood transfusion	0.8	2.6	0.3	2.0
Unknown	55.3	64.4	50.9	66.4
Clinical characteristics				
Jaundice	81.5	75.0	83.4	76.9
Hospitalized for hepatitis	28.2	21.0	25.5	36.0
Death as a result of hepatitis	1.4	0.0	1.1	2.1

* In decreasing order of exclusion.
+ Number includes age unknown.
Source: Viral Hepatitis Surveillance Program

was insufficient to determine how transmission occurred. Employment in the medical or dental field, blood transfusions, and dialysis accounted for less than 5% of cases. For those patients employed in a medical, dental or other field involving contact with human blood, 23% reported frequent blood contact in 1993, down from 36% in 1992. Transfusion as a source for HBV has remained at a low level (0.8%) because of routine screening of blood donors for HBsAg and anti-HBc, and because of donor selection and deferral procedures. Screening for HBsAg has been mandatory since 1972. Smaller improvements in preventing post-transfusion hepatitis B occurred in the mid-1980s, with self-exclusion of high-risk donors related to the prevention of human immunodeficiency virus (HIV) infection and later anti-HBc screening. Hepatitis B among children younger than 15 years old is associated primarily with personal contact with another infected person. The percentage for 1993, 26%, is somewhat higher than the 22% reported in 1992. None of these patients reported injection drug use, while 6% reported multiple sex partners in 1993 as their primary risk factor. The percentages of persons reporting no known source of infection in the youngest and oldest age-groups were similar to those reported in 1992.

To ensure that possible biases owing to artifactual decreases in reporting were minimized, the analysis of trends in hepatitis B risk factors for 1983 to 1993 was restricted to the absolute numbers of cases reported in the core states only. For these states during 1989-1993, decreases occurred in the numbers of cases attributed to injection drug use (an 83% decrease), personal contact with a hepatitis B patient (73% decrease), and multiple sexual partners (35% decrease).

The trends in risk factors associated with hepatitis B in the core states, among men and women separately, are shown in Figures 3 and 4. Among men, injection drug use has shown the largest change from 1983 to 1993. After an increase of 116% from 1983 to 1989, the numbers of cases among men attributed to injection drug use decreased by 85% (Figure 3). Safer needle-using practices, or changes in the types of drugs used (injection to noninjection) are possible reasons for this reduction. The numbers of cases among men attributable to personal contact with another hepatitis B patient has been more stable, showing a gradual decline from 1989 to 1993. For these male patients, 52% to 67% of contacts were sexual, while 13% to 20% were household contacts. Homosexual activity, the second most commonly reported risk factor, declined to its lowest level in 1993. Declines in the other reported risk factors — health-care employment and blood transfusion — continued through 1993.

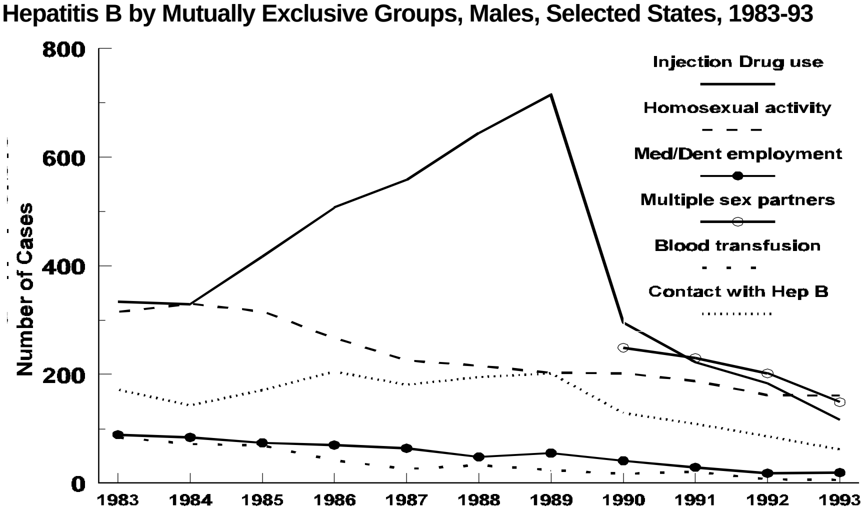
Risk factors for women with hepatitis B displayed some of the same trends presented for men, with injection drug use as a risk factor increasing from 1983 to a peak in 1989 (Figure 4), followed by a drop to pre-1983 levels. However, among women, contact with another hepatitis B patient increased more dramatically than among men and since 1990, was reported with a higher frequency than injection drug use. As with men, the majority of contacts associated with such cases have been sexual, reaching 72% in 1993, while only 11% have been household contacts.

The decrease in the percentage of female patients reporting medical and dental employment as a risk factor during 1983-1993 has been more pronounced than that for men. This decline is most probably attributable to immunization of health-care workers with hepatitis B vaccine. The percentage of cases attributable to blood transfusions has remained at low levels since 1988. The same trends in both men and women have been observed in the Sentinel Counties study(19).

Jaundice as a clinical characteristic of hepatitis B is a common symptom in patients over 10 years of age (Table 5); 82% of all patients were reported with jaundice, regardless of age. As with hepatitis A, jaundice and other symptoms were notably less frequent for young children, suggesting more extensive underrepresentation of this age-group among reported cases. Overall hospitalization rates remained stable, showing little change since 1988, but the rates of hospitalization for patients 40 years old and older dropped slowly but steadily, from 50% in 1985 to 36% in 1993. Death as a result of hepatitis B was reported in approximately 1% of patients in 1993.

Nationwide, the incidence of hepatitis B increased by 67% from 1978 to 1985 and then declined to its low-

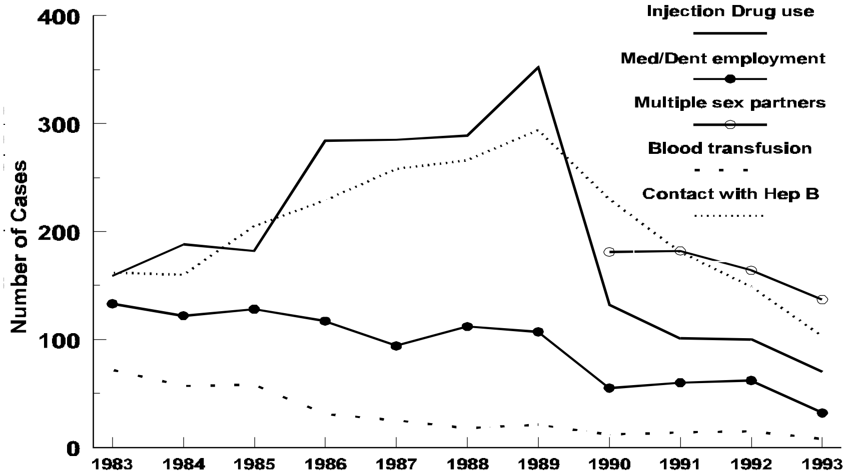
Figure 3. Trends in Selected Risk Factors for Patients Reported with Hepatitis B by Mutually Exclusive Groups, Males, Selected States, 1983-93



Source: VHSP, CDC. Cases from 15 selected states with high reporting levels.

est incidence since 1974. Since its original licensing in 1981, hepatitis B vaccine has been used in increasing quantities each year. However, the role of the vaccine in the decline of the incidence of hepatitis B varies across risk groups. From 1985 to 1989, hepatitis B among homosexual men declined more rapidly than among other risk groups, not because of vaccine use but because of behavioral changes resulting from awareness of acquired immunodeficiency syndrome (AIDS)(7). Hepatitis B also declined among health-care workers during this period, who were the largest users of hepatitis B vaccine. From 1989 to 1993, hepatitis B among injection drug users declined by 46% despite the low levels of vaccine usage in this risk group. Hepatitis B among heterosexuals decreased during this period also, possibly due to wider use of vaccine.

Figure 4. Trends in Selected Risk Factors for Patients Reported with Hepatitis B by Mutually Exclusive Groups, females, Selected States, 1983-93



Source: VHSP, CDC. Cases from 15 selected states with high reporting levels.

Vaccination programs and vaccine usage have been focused primarily on three risk groups: health-care workers who are exposed to blood, staff and residents of institutions for the developmentally disabled, and staff and patients in hemodialysis units (9). For health-care and public safety workers, the Department of Labor in 1991 issued regulations that require employers to offer hepatitis B vaccine to persons at occupational risk of infection. However, the ability to immunize the groups that account for most of the HBV infections is severely limited for several reasons: the failure both of health-care providers and of the target populations to recognize the specific groups at high risk for infection; the difficulty in identifying persons with these high-risk behaviors before they become infected; and the difficulties in reaching these groups for the delivery of vaccine and at the appropriate time for vaccination (7).

Adults in general, and groups such as injecting drug users in particular, are extremely difficult to access for delivery of vaccine (11). In addition, once persons begin the lifestyles associated with a high-risk group, they may become infected before vaccine can be given. Thus, the major obstacles to reducing the incidence of HBV infection in the United States have been the difficulties in identifying persons before they become infected and vaccinating them promptly. To overcome these problems, the Immunization Practices Advisory Committee recommended in 1991 a program of routine vaccination of all infants (9). In 1995 the same committee recommended the expansion of this program to cover 1) vaccination of all unvaccinated children aged <15 years who are Pacific Islanders or who reside in households of first-generation immigrants from countries where HBV is of high or intermediate endemicity; and 2) vaccination of all 11- to 12-year-old children who have not previously received hepatitis B vaccine (9).

Hepatitis C/Non-A, Non-B Hepatitis

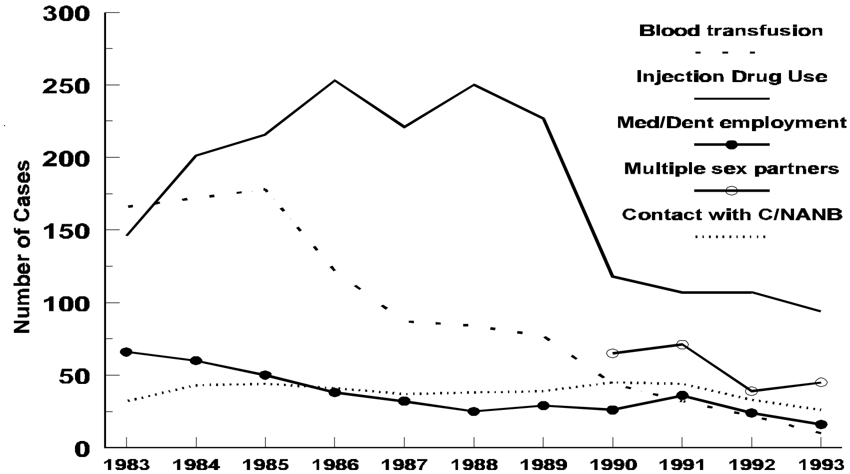
Based on the crude frequencies with which risk factors were reported, injection drug use was the risk factor most commonly reported by hepatitis C/NANB patients (Table 3). Many of these persons also reported more than one potential source of infection. Of those reporting contact with another person with hepatitis C/NANB, 25% also reported injection drug use and 5% reported employment in a medical or a dental field. Of those reporting multiple sex partners, 35% also reported injection drug use.

The behaviors commonly associated with hepatitis A that were reported by persons with hepatitis C/NANB to have occurred within 6 weeks of illness are generally not applicable to the transmission of hepatitis C/NANB (Table 3). Since transmission of NANB hepatitis by the fecal-oral route has not been demonstrated in this country, reporting an association with a foodborne or a waterborne outbreak represents misclassification of the source.

As with hepatitis B, potential exposures associated with dental work, surgery, acupuncture, tattooing, and other percutaneous procedures are not judged to be probable sources of sporadic infection (12). Hepatitis C/NANB patients with no known source of infection reported these exposures at rates no different from those of the general population.

Based on assignment to mutually exclusive categories, persons with hepatitis C/NANB reported injection drug use most frequently, accounting for 23% of cases during 1993 (Table 6). Blood transfusion accounted for 2% of cases, declining from 6% in 1990; contact with another infected person accounted for 5%, and health-care employment for 4%. Of those patients reporting health-care employment, the percentage reporting frequent (several times weekly) blood contact dropped over 1990 to 1993. Fifty-seven percent of patients employed in health-care reported frequent blood contact in 1990. By 1993, the percentage dropped to 17%. Patients classified as having multiple (2 or more) sex partners as their most likely source of infection accounted for 7% of the patients with hepatitis C/NANB; in a case-control study, this risk factor was associated with acquiring disease (12). Overall, 58% of persons reported no known source for their infection. This percentage varied by age, with 70% of persons younger than 15 years old or 40 years old and older reporting no known source for their infection, compared with 50% for persons 15-39 years of age. Among persons less than 15, 13.6% had a history of blood transfusion.

Figure 5. Trends in Selected Risk Factors for Patients Reported with Hepatitis C/NANB, by Mutually Exclusive Groups, Selected States, 1983-93



Source: VHSP, CDC. Cases from 15 selected states with high reporting levels.

Among persons 15 to 39 years of age, injection drug use was reported by 28% of all cases during 1993, unchanged from 1992 (Table 6). Ten percent reported multiple sex partners, 7% reported contact with another infected person, 4% reported health-care employment, and 1% reported blood transfusions. Of reported contacts with another infected person, an average of 59% were sexual contacts, 16% were household nonsexual contacts, and 25% were other (unspecified) types of contact. In prior years, persons 40 years old and older reported a history of blood transfusion most frequently among their risk factors (in 1990, 16%), but this percentage declined substantially to 4% by 1993. Injection drug use is now the most frequent risk factor for this age-group (Table 6).

Because total numbers of cases of hepatitis C/NANB have declined, trends in the distribution of risk factors are more accurately reflected by trends in the absolute numbers of cases attributed to each factor. In the core states, hepatitis C/NANB cases attributable to drug use have declined rapidly since 1988, showing a more than 62% decrease (Figure 5). A similar decrease of over 50% was seen in the Sentinel Counties Study (14).

The numbers of hepatitis C/NANB cases attributable to blood transfusions have decreased even more dramatically, dropping by 94% from 1985 to 1993. The significant decline in transfusion-associated cases,

Table 6. Epidemiologic and Clinical characteristics of Patients Reported with Hepatitis C/Non-A, Non -B Hepatitis, by Age Group, United States, 1993

	Percentage of Patients By Age (years)			
Epidemiologic Characteristics for Prior 6 weeks by Mutually Exclusive Groups*	**Total N = 856+**	**<1-14 N = 30**	**15-39 N = 557**	**40+ N = 260**
Blood transfusion	2.3	13.6	0.9	4.3
Injection drug use	22.6	0.0	28.4	12.0
Employed in medical/dental field	3.9	0.0	3.8	4.6
Hemodialysis	0.7	0.0	0.2	1.9
Personal contact with hepatitis C/NANB patient	5.3	6.7	7.2	1.2
Multiple sex partners	7.4	0.0	9.9	3.1
Unknown	57.8	79.7	49.6	72.9
Clinical characteristics				
Jaundice	66.9	75.0	69.6	60.1
Hospitalized for hepatitis	32.9	32.1	28.8	41.7
Death as a result of hepatitis	1.9	0.0	0.8	4.5

* In decreasing order of exclusion.
+ Number includes age unknown.
Source: Viral Hepatitis Surveillance Program

which began in the mid- 1980s, resulted from a series of events: changes in the blood donor population caused by self-exclusion of high-risk donors, as part of efforts to prevent HIV infection (15,16); the introduction of screening blood donors for alanine aminotranferase and anti-HBc as surrogate markers for hepatitis C/NANB in 1986 and 1987; and use of first- and second-generation anti-HCV markers for screening donors in 1990 to the present.

Jaundice was reported as a clinical symptom in 67% of reported hepatitis C/NANB patients in 1993 (Table 6). Hospitalization and case-fatality rates were higher in hepatitis C/NANB patients than in patients with hepatitis A or B. Those 40 years old and older experienced the highest rates.

The majority of NANB hepatitis cases in this country are caused by the hepatitis C virus (14); the remainder are probably due mostly to other bloodborne hepatitis agents. Outbreaks of hepatitis E, an enterically transmitted form of hepatitis NANB, have been reported in rural Mexican villages (17), as well as in Asia and North and West Africa (18), but no outbreaks have been reported in this country (19). In the United States and other countries where hepatitis E outbreaks have not been documented to occur, rare hepatitis E cases have been reported, primarily among travelers returning from HEV-endemic regions (20). No secondary transmission to family members or other persons in association with these cases has been reported. In the United States, hepatitis E cases have been reported with no history of travel to HEV-endemic areas; however, the mode of HEV transmission for these cases has not been determined.

Discussion

Viral hepatitis surveillance in 1993 revealed several important changes from earlier years. First, total cases reported to the VHSP declined more than 51% from 1990 to 1993, as a result of both real declines in the incidence of hepatitis A and B, and a number of states that previously reported now submitting fewer or none of their cases to the VHSP. Second, the use of serologic tests to diagnose the specific type of hepatitis has declined, with fewer reported cases being diagnosed on the basis of tests for both hepatitis A and B. Third, analysis of trends in risk factors for the acquisition of the different types of hepatitis indicated that injection drug use has declined dramatically for hepatitis A, B, and hepatitis C/NANB. Finally, more widespread use of hepatitis B vaccine may be having an effect on the number of hepatitis B cases acquired by heterosexual activity.

Underreporting and incomplete case ascertainment are potential sources of inaccuracy and may lead to inaccurate conclusions from surveillance data, particularly in the relative frequencies of reported risk factors (21). Since case ascertainment is dependent on the availability of sensitive and specific serologic tests, estimates of the frequency of disease types such as hepatitis C/NANB, for which there are no markers of acute disease, are likely to be the least reliable. The analysis of VHSP data on biases in the reporting of hepatitis B and hepatitis C/NANB showed that consistent reporting practices are critical for the accurate interpretation of surveillance data in this country. In addition, national data are averaged over many regions with potentially large geographic differences in risk factors and disease incidence. Therefore, the overall frequencies of various risk factors may not reflect their importance in smaller geographic areas.

Despite the drawbacks associated with a passive surveillance system, the data collected through the VHSP are essential for monitoring trends in the epidemiologic characteristics of the various types of viral hepatitis. These data are also valuable for monitoring the impact of prevention programs on disease in various high-risk groups, such as those targeted to receive hepatitis B vaccine. The recently recommended program for the universal immunization of infants for hepatitis B was the direct result of the analysis of surveillance data, and provides evidence that contributors to the VHSP have made a positive impact on public health.

Many dedicated public health practitioners, local medical authorities, and public health communities contribute to this surveillance system through their timely diagnosis and reporting of hepatitis cases. We are grateful for their continued participation and encourage them to continue to improve their use of serologic testing, their consistency in reporting, and the quality of the information they provide.

References

1. McQuillan GM, Townsend TR, Fields HA, et al. Seroepidemiology of hepatitis B virus infection in the United States. Am J Med 1989;87(suppl 3A):5S-10S.
2. Francis DP, Maynard JE. The transmission and outcome of hepatitis A, B, and non-A, non-B: a review. Epidemiol Rev 1979;1:17-31.
3. Corey L, Holmes KK. Sexual transmission of hepatitis A in homosexual men—incidence and mechanism. N Engl J Med 1980;302:435-8.
4. Dienstag JL, Ryan DM. Occupational exposure to hepatitis B virus in hospital personnel: infection or immunization? Am J Epidemiol 1982;115:26-39.
5. Hadler SC, Doto IL, Maynard JE, et al. Occupational risk of hepatitis B infection in hospital workers. J Infect Control 1985;6:24-31.

6. Schreeder MT, Thompson SE, Hadler SC, et al. Hepatitis B in homosexual men: prevalence of infection and factors related to transmission. J Infect Dis l982;146:7-15.
7. Alter MJ, Hadler SC, Margolis HS, et al. The changing epidemiology of hepatitis B in the United States. JAMA 1990;263:1218-22.
8. Immunization Practices Advisory Committee. Recommendations for protection against viral hepatitis. MMWR 1985;34:313-24,329-35.
9. Immunization Practices Advisory Committee. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination. MMWR 1991;40:1-25.
10. Immunization Practices Advisory Committee. Update: recommendations to prevent hepatitis B virus transmission — United States. MMWR 1995;44:574-5.
11. Margolis HS, Alter MJ, Hadler SC. Hepatitis B: evolving epidemiology and implications for control. Semin Liver Dis 1991;11:84-92.
12. Alter MJ, Coleman PJ, Alexander WJ, et al. Importance of heterosexual activity in the transmission of hepatitis B and non-A, non-B hepatitis. JAMA 1989;262:1201-5.
13. Alter MJ, Hadler SC, Judson FN, et al. Risk factors for acute non-A, non-B hepatitis in the United States and association with hepatitis C virus infection. JAMA 1990;264:2231-5.
14. Alter MJ. The detection, transmission, and outcome of hepatitis C virus infection. Infectious Agents and Disease 1993;2:155-66.
15. Aach RD, Szmuness W, Mosley JW, et al. Serum alanine aminotransferase of donors in relation to the risk of non-A, non-B hepatitis in recipients. N Engl J Med 1981;304:989-94.
16. Koziol DE, Holland PV, Alling DW, et al. Antibody to hepatitis B core antigen as a paradoxical marker for non-A, non-B hepatitis agents in donated blood. Ann Intern Med 1986;104:488-95.
17. CDC. Enterically transmitted non-A, non-B hepatitis—Mexico. MMWR 1987;36:597-602.
18. Bellabbes EH, Bourguermouh A, Benatallah A, Illoul G. Epidemic non-A, non-B hepatitis in Algeria: strong evidence for its spreading by water. J Med Virol 1985;16:257-63.
19. Mast EJ, Alter MJ. Epidemiology of viral hepatitis: an overview. Seminars in Virology 1993;4:273-83.
20. DeCock KM, Bradley DW, Sandford NG, Govindarajan S, Maynard JE, Redeker AG. Epidemic non-A, non-B hepatitis in patients from Pakistan. Ann Intern Med 1987;106:227-30.
21. Alter MJ, Mares A, Hadler SC, Maynard JE. The effect of underreporting on the apparent incidence and epidemiology of acute viral hepatitis. Am J Epidemiol 1987;125:133-9.

Appendix (Form CDC 53.1 Rev. 8-89)

State and Territorial Epidemiologists and Laboratory Directors

Key to all disease surveillance activities are the state and territorial epidemiologistsand laboratory directors. The epidemiologists and laboratory directors listed below were in the positions shown as of June 1995.

State/Territory	Epidemiologist	Laboratory Director
Alabama	John P. Lofgren, MD	William J. Callan, PhD
Alaska	John P. Middaugh, MD	Gregory V. Hayes
Arizona	Lawrence Sands, DO, MPH	Barbara J. Erickson, PhD
Arkansas	Thomas C. McChesney, DVM	Michael G. Foreman
California	Duc J. Vugia, MD, MPH	Michael G. Volz, PhD
Colorado	Richard E. Hoffman, MD, MPH	Ronald L. Cada, DrPH
Connecticut	James L. Hadler, MD, MPH	Sanders F. Hawkins, PhD
Delaware	A. LeRoy Hathcock, PhD	Mahadeo P. Verma, PhD
District of Columbia	Martin E. Levy, MD, MPH	James B. Thomas, ScD
Florida	Richard S. Hopkins, MD, MSPH	E. Charles Hartwig, ScD
Georgia	Kathleen E. Toomey, MD, MPH	Elizabeth A. Franko, DrPH
Hawaii	Richard L. Vogt, MD	Vernon K. Miyamoto, PhD
Idaho	Jesse F. Greenblatt, MD, MPH	Richard H. Hudson, PhD
Illinois	Byron J. Francis, MD, MPH	David F. Carpenter, PhD
Indiana	Edmundo M. Muniz, MD, PhD, Msc	Barbara Wilder (Acting)
Iowa	M. Patricia Quinlisk, MD, MPH	W. J. Hausler, Jr, PhD
Kansas	Andrew R. Pelletier, MD	Roger H. Carlson, PhD
Kentucky	Reginald Finger, MD, MPH	Thomas E. Maxson, DrPH
Louisiana	Louise McFarland, DrPH	Henry B. Bradford, Jr, PhD
Maine	Kathleen F. Gensheimer, MD, MPH	Philip W. Haines, DrPH
Maryland	Diane M. Dwyer, MD	J. Mehsen Joseph, PhD
Massachusetts	Alfred DeMaria, Jr, MD	Ralph J. Timperi, MPH
Michigan	Kenneth R. Wilcox, Jr, MD, DrPH	Robert Martin, DrPH
Minnesota	Michael T. Osterholm, PhD, MPH	Pauline Bouchard, JD, MPH
Mississippi	Mary Currier, MD, MPH	Joe O. Graves, PhD
Missouri	H. Denny Donnell, Jr, MD, MPH	Eric C. Blank, DrPH
Montana	Todd D. Damrow, PhD, MPH	Douglas O. Abbott, PhD
Nebraska	Thomas J. Safranek, MD	John D. Blosser
Nevada	Randall L. Todd, DrPH	Arthur F. DiSalvo, MD
New Hampshire	M. Geoffrey Smith, MD, MPH	Veronica C. Malmberg, MSN
New Jersey	Kenneth C. Spitalny, MD	Shahiedy I. Shahied, PhD
New Mexico	C. Mack Sewell, DrPH, MS	Loris W. Hughes, PhD
New York City	Benjamin A. Mojica, MD, MPH	Stanley Reimer
New York State	Dale L. Morse, MD, MS	Lawrence S. Sturman, MD, PhD
North Carolina	J. Newton MacCormack, MD, MPH	Samuel N. Merritt, DrPH
North Dakota	Larry A. Shireley, MS, MPH	James D. Anders, MPH
Ohio Thomas	J. Halpin, MD, MPH	Kathleen L. Meckstroth, DrPH
Oklahoma	Joe P. Mallonee, MPH (Acting)	Garry L. McKee, PhD
Oregon	David Fleming, MD	Michael R. Skeels, PhD, MPH
Pennsylvania	James T. Rankin, Jr, DVM, PhD, MPH	Bruce Kieger, DrPH
Rhode Island	Barbara A. DeBuono, MD, MPH	Walter Combs, PhD
South Carolina	James J. Gibson, MD, MPH	Harold Dowda, PhD
South Dakota	Susan E Lance, DVM, MPH	Richard S. Steece, PhD
Tennessee	Kerry Gateley, MD	Michael W. Kimberly, DrPH
Texas	Diane M. Simpson, MD, PhD	David L. Maserang, PhD
Utah	Craig R. Nichols, MPA	Charles D. Brokopp, DrPH
Vermont	Robert O'Grady (Acting)	Burton W. Wilke, Jr, PhD
Virginia	Grayson B. Miller, Jr, MD	James L. Pearson, DrPH
Washington	Paul Stehr-Green, DrPH, MPH	Jon M. Counts, DrPH
West Virginia	Loretta E. Haddy, MA, MS	Frank W. Lambert, Jr, DrPH
Wisconsin	Jeffrey P. Davis, MD	Ronald H. Laessig, PhD
Wyoming	Gayle L. Miller, DVM, MPH	Carl H. Blank, DrPH
American Samoa	Julia L. Lyons, MD, MPH	—
Federated States of Micronesia	Vacant	—
Guam	Robert L. Haddock, DVM, MPH	Jeff Benjamin (Acting)
Marshall Islands	Tony de Brum	—
Northern Mariana Islands	A. Mark Durand, MD, MPH	—
Palau	Jill McCready, MS, MPH	—
Puerto Rico	Carmen C. Deseda, MD	Adolpho Firpo-Betancourt, MD
Virgin Islands	Donna M. Green, MD	Norbert Mantor, PhD